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Computer Education Curriculum for Schools

An Integrated Approach

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Abstract

Recently, the computer has become one of the major assets of many schools. Schools in the cities are offering computer courses realizing the potential of global markets. Some states are in the process of introducing computer education as a school subject in secondary and higher secondary schools. But, it has been felt that there is not a single, sound computer education curriculum available. Schools prepare their own computer education curriculum. There is a dire need for a sound computer education curriculum for our schools. In the present paper the researchers have tried to prepare an integrated computer education curriculum for schools.

In January 2001 the National Council of Educational Research and Training brought out ***Information Technology in Schools : Curriculum Guide and Syllabus*** for primary, middle and secondary classes. –ACADEMIC EDITOR

APPLICATION of educational technology is considered very important for the Indian school system. It is now being emphasized in all the schools, rural and urban, and in all the stages, from elementary to higher secondary, in the form of instructional design (technology), hardware technology and software technology. The practical aspect of its utilization varies from school to school. In many schools, particularly private schools in urban areas, its application exists in many areas like teaching-learning, admission, evaluation, guidance and counselling, and teachers' training. The use of computers is one of the major applications of educational technology in these schools, either due to its huge potentiality to reduce educational and management burden and/or to attract more students. Schools with adequate facilities for computer hardware, software and 'humanware', use computers for many educational purposes. It shows that there has been a significant growth of computer education in Indian schools during the last decade. In spite of resource crunch, there is a rapid expansion of computer facilities in schools, particularly, in private schools, Central Schools and Navodaya Vidyalayas. There is a great rush of students to these schools both in rural and urban areas, perhaps due to these facilities.

Computers are used in schools in two ways, first, as a tool to teach other subjects, and second, to teach computer education as a subject. In the first use, the computer is used to teach subjects like physics, chemistry, biology, etc. through Computer Assisted Instruction (CAI). In the second and important use, schools use computers to teach computer education as a subject. Here, various packages and languages are taught in the schools. Packages like Wordprocessor, Data Base Management Packages (dBASE, Foxpro, Sibase), LOTUS 1-2-3, Excel, etc. and languages like BASIC, Logo, C, Pascal, etc. are taught in the schools.

In many schools, the teaching of computer education is not according to the psychological and pedagogical principles of learning. Even the computer education curriculum is not compatible to the schools and the computer teachers are not well qualified. In many schools, computers are either unutilized or underutilized. There is no exact stage for introducing computer education in schools. Some schools have introduced computer education in the nursery, some in Class I, and often in Class II, III, or IV. In many schools there is no fixed period for computer education in their regular time-table and students use computers only in their SUPW (Socially Useful Productive Work) classes. The analysis of Computer Literacy and Studies in Schools (CLASS) project reveals that one of the main causes of the failure of the CLASS project is "no provision of special computer periods in the school time-table."

Computer education is also not a regular subject in secondary and higher secondary curricula. It is considered as an extra subject. Many schools do not provide computer education in secondary and higher secondary classes But in this age of computers, computer education is needed for all streams, be it arts, commerce or science. At least, there should be a structured syllabus for all the classes which would be integrated in nature. Most of the languages and packages of computers are based on logic. To master any one of the computer languages or packages, there is need for sound logic. Computer education should be offered to students in such a way that they would be able to master simple logic first and gradually proceed to complex logic. The syllabus of computer education should proceed from simple to complex logic and from small information to large information. It should be according to the mental level, maturity and interest of the students The present paper is based on a study aimed at preparing a suitable computer education curriculum for schools Attempts have been made to deal with the following aspects related to computer education,

- Status of computer education in city schools.
- Need of a suitable computer education curriculum in schools.
- Exact stage of introducing computer education in schools
- Designing relevant, stagewise computer education curricula for schools based on psychological and pedagogical principles.
- Integration of computer education in regular school schedules.

Objectives

The study was conducted with the following objectives.

1. To study the existing status of computer education in the schools of Vadodara City
2. To prepare suitable computer education curricula for schools according to the need of different classes

Sample

Twenty schools with computer facilities from Vadodara City were taken purposively as the sample for the study. Twenty experts from the field of computer education were taken to collect their suggestions about the proposed computer education curriculum for schools.

Tools

A questionnaire was prepared by the investigators to collect data from the sample schools about their existing computer education The items in the questionnaire were both open as well as close ended. To collect suggestions from experts about a computer education curriculum for schools, an interview schedule was prepared by the researchers.

Data Collection

Data was collected from the sample schools of Vadodara City about the existing computer education and computer education curriculum, available infrastructure, hardware and software, entry stage for computer education, allotment of periods for computer education, number of computer teachers, qualification of computer teachers, etc. Literature was also collected to find out research studies regarding the preparation of computer education curriculum. Experts' suggestions were taken about the stage of introducing computer education in schools, the type of courses to be taught in different classes, the weightage for computer education in comparison to other subjects at different stages, etc.

The collected data were analyzed with the help of frequency, distribution and percentage

Findings and Discussion

Following are the findings of the study presented objectivewise

(i) *Existing Hardware*

In all the schools there were well-equipped computer laboratories In 15 per cent of the schools there were two computer laboratories, one for primary classes and another for secondary and higher secondary classes In most of the schools, there were separate computers for primary and secondary classes. The primary students mostly used PC/XT machines without hard disk or with hard disk of very small disk space like 40 MB or 80 MB In 25 per cent of the schools the computer laboratories were air-conditioned. The number of computers in the schools varied from 14 to 35. In 50 per cent schools the number of computers within 14 to 17. In 40 per cent schools the number of computers was within 18 to 22 and in 10 per cent schools it was 35 and more. In most of the schools they had PC/AT, 80386 and 80486. In 20 per cent of the schools they had multimedia systems In 10 per cent schools they had networking system (LAN). In most of the schools, they had printers and the number varied from 2 to 4

(ii) *Existing Software*

All the schools had common software like DOS, Wordstar (version 4 to 7), LOTUS 1-2-3, MS-Office, dBASE, Foxbase, Logo, Print Master, Banner. Thirty-five per cent of the schools had Windows In 60 per cent schools they had BASIC, C^{++}, Havard Graphic, Coral Draw Twenty per cent schools had CD ROMs for multimedia. Most of the schools did not have any CAI and related software to teach other school subjects

(iii) *Existing Humanware*

Most of the schools had computer teachers who were graduates and held a diploma in computer education Forty per cent of the schools had computer teachers with three years' experience in business computing. Twenty per cent of the schools had computer teachers with the said qualification along with a B.Ed. degree Forty per cent of the schools had two computer teachers and ten per cent schools had four computer teachers

(iv) *Existing Syllabus*

The syllabus in computer education differed from school to school. In most of the schools the computer education syllabus had been prepared by their own computer teachers, and in some schools, the syllabus had been borrowed from some other schools.

None of the schools used computers to teach subjects other than computer education.

Regarding the courseware, 50 per cent of the schools had Fundamentals of computers, Logo, Lower Basic, Games, print master in their primary school (I-IV) syllabus. Fifteen per cent of the schools had Wordstar and DOS in their primary school syllabus. Five per cent schools had flow-charting in their primary school syllabus. All the schools had LOTUS 1-2-3, dBASE, Foxbase, advanced DOS and advanced BASIC in their secondary syllabus Thirty per cent of the schools had C^{++}, Havard Graphic, Coral Draw, MS-Office, MS-Windows, etc in their secondary school syllabus One hundred and fifty-five schools had networking, Pagemaker, and Power Builder in their secondary school syllabus. Most of the schools did not provide computer education for Classes X to XII students.

Regarding the rationale for their computer education syllabus, the response of the schools was very poor. Most of the computer education teachers, i.e 90 per cent had not responded to this item. From their syllabus, it was found that there was neither rationale nor logic behind their syllabus Most of the schools kept one or two packages or languages for one class and some other packages or languages for other classes. For example, 15 per cent schools kept Wordstar for Class VI, BASIC for Class VII, Lotus 1-2-3 for Class VIII and dBASE for Class IX.

In most of the schools, students other than students of Classes X and XII got enough time for computer education theory and practical classes. In some schools (20 per cent) students were allowed to practise computers in their leisure time also. In all the schools computer education classes were included in the general time-table.

(v) *Stage of Introduction*

Fifty per cent of the schools introduced computer education in Class III Forty per cent schools introduced computer education in Class II and 10 per cent schools introduced it in Class VIII In 50 per cent schools computer education continued upto Class IX, in 30 per cent schools upto Class VIII and in 20 per cent schools upto Class VII

From the drawn findings it could be concluded that most of the schools had enough manpower, machine and software for the implementation of a complete and effective computer education curriculum But it was found that students and school authorities were not much interested in computer education as it was not considered as a subject in Classes X and XI. It was considered a waste of time for the students who were going to appear in the board examinations. To solve this problem, it is essential on the part of the State Government and the Central Government to include computer education as a compulsory or as an optional subject in the board syllabus. As most of the schools did not have a proper syllabus for computer education nor proper guidelines to indicate the correct stage for introducing computers the need for preparing a suitable computer education curriculum for schools in Vadodara City including Classes X, XI and XII was further realized For this purpose the opinions of experts in the area of computer education were sought which are as follows and are related to Objective 2 of the study

(i) Stage of Introduction

According to 80 per cent experts, computer education should be introduced in Class I. If possible, it may be introduced at the nursery stage. At this stage the students can play with computers Graphic packages including animation, simulations, nursery rhymes, games, etc could be introduced at this stage. With the help of these packages children will develop interest in computers and it will also help develop a sense of computer awareness among students It should be continued upto Class V In Class IV and V, fundamentals of computers like history of computers, types of computers, uses of computers, functions of computers, etc. should be introduced through the play-way method in a very casual way. From nursery to Class V there should not be any examination or test on the subject of computer education. Towards the end of Class V a language like LOGO could be introduced At this stage, it would be totally practical, and theory classes should be kept to a minimum

(ii) Type of Curriculum

According to most of the experts, there should be an integrated computer curriculum from Class VI to XII Integrated course means that some packages or languages with different purposes should be integrated over all the Classes from VI to XII. For example, wordprocessing should be included in all the classes from Class VI to Class XII. Any two wordprocessing packages should be spread over these years from simpler to complex components. This would help reduce forgetting and also increase efficiency due to practice

(iii) Components of the Curriculum

According to the experts, there should be one Disk Operating System (DOS) or its equivalent like Windows or UNIX, one/two wordprocessing package, one language like BASIC or C for a proper development of computer logic and one Database Management package like dBASE or Foxpro, for each class from VI to XII. Some useful packages should be introduced in between these classes In the higher secondary classes there should be some professional packages for different streams which would enhance the students' job prospects. According to the experts' suggestions, there should be 60 per cent practical and 40 per cent theory classes. Equal weightage should be given to computer education as compared to other compulsory subjects and it should be considered as one of the optional subjects in secondary and higher secondary board examinations

(iv) Teachers for Computer Education

According to the experts, computer teachers for primary Classes (I–V) should preferably be lady teachers with the minimum diploma in computer software or computer application. Preference should be given to teachers with this qualification along with primary teacher training

Computer teachers for secondary and higher secondary classes should be trained graduates with a diploma/degree in computers and/or some experience in the field of computer application According to the suggestion of experts, more computer professionals should be encouraged to teach by giving them an attractive salary.

On the basis of experts' suggestions, availability of software and hardware and competency of humanware, the following languages and packages were suggested for secondary and higher secondary classes.

- DOS 6 2 and the version above it would be considered as the Disk Operating System from Class VI to IX and Windows for Classes X, XI and XII
- BASIC for Classes VI to IX and C for Classes X, XI and XII
- From the Database Management Systems, dBASE III or IV would be included in the syllabus from Class VI to IX and it would be extended by FOXPRO for Classes X, XI and XII
- Wordstar (versions 4 to 7) for Classes VI to IX to be replaced by MS-WORD from Class X to Class XII.
- LOTUS 1-2-3 would be introduced in Class IX and it would continue upto Class X.

Taking into consideration the findings and experts' opinions discussed above, a detailed computer education curriculum has been suggested which is given as Appendix (pp 11–15). Also, detailed objectives are stated as follows for different stages which would be achieved with the help of the proposed curriculum

Objectives of Computer Education

Primary Stage (Nursery, KG, Classes I-V)

- To create interest about the world of computers.
- To create computer awareness and literacy.

Secondary Stage (Classes VI-X)

- To develop sound logic among students.
- To make the students familiar with different languages and packages
- To make the students master certain languages and packages
- To develop a strong foundation for further studies in computers

Higher Secondary (Classes XI and XII)

- To develop vocational skills in computers for future life
- To develop creativity in the area of computers
- To develop a stronger foundation for further studies in computers.

Computer education is an emerging area of education. The demand for computer personnel is increasing in all sectors in India as well as abroad. To cope with the present and future demand, there is need for introducing computer education in all stages of education including school and university education. Though more and more facilities exist for college students in the form of private computer institutes and technical institutes, there is a dire need to extend those facilities to school education. To start with, there is a strong need for a structured curriculum for computer education at the school level. The curriculum given in this paper is an attempt in this direction.

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APPENDIX

Proposed Integrated Computer Education Curriculum

In this proposed 'Integrated Computer Education Curriculum' different packages and languages are proposed for different classes in an integrated manner which are given in tabular form as follows

Fundamentals of Computer Education

Classes			
Nursery, K G , I, II	III	IV	V
Stories about the computer, it's work efficiency, Fictions about computers, Games; Rhymes through computers; Alphabet, Tables through computers, Animations and simulations on computers, Computer graphics, Introduction to keyboard (only some keys like arrow keys, enter key, escape key and space bar) +	Games, Computer puzzles, Scoring games, Adventure games, Computer graphics; Animation and simulation, Introduction to keyboard (letters) +	Games, Calculation through computers, Parts of computers; Use of computers in different fields, History of computer through story-telling + *	Creative games, Calculating through computers, How to start and shut down computers, Computer peripherals (in detail), Keyboard practice, Introduction to LOGO * +

+ The purpose of the game is to create an interest in computers

* Lower level Wordprocessor can be introduced in Classes IV and V Paint Brush of Windows also can be introduced.

DOS (Disk Operating System)

Classes				
VI	VII	VIII	IX	X
DIR-CD/MD/ RD, Date, Time, CLS, Copy (General), Tree, VER, VOL *	Copy (Advance) REN, DEL, UNDEL, Format, Unformat, Edit, Wildcards, CHDIR, CHKDSK *	XCopy, How MS DOS organizes information, PATH, SCANDISK DELTREE, DEVICE ECHO, FDISK, SET MODE, MORE, PRINT, Getting help, Backup, Comparing file, Restoring file, Virus concept, Graphics, Share, Install **	CHKDSK, CONFIG SYS, AUTOEXEC BAT, Memory, configuration, MEMMAKER, MS-DOS Partition Logical device, Graphics, ZIP, INZIP, VSAFE, SMART DRIVE, Trouble shooting, Server, Interlink, Shell, Qbasic Fundamentals **	Windows

* Additional information about LAN, node, server, receiver and sender can be given.

** Windows can be started instead of DOS in lower classes and, further, in Classes X, XI, and XII UNIX can replace Windows

(Word Processor) Wordstar

Classes				
VI	VII	VIII	IX	X
Introduction, Document, Non-Document, Exit, Save, Print, Cursor movement, Rules of typing, Change dir, On format menu	Advanced edit, Commands, Rules of typing, Copy a file, Rename, Block commands, Advance cursor movement Help, Print control.	Dot commands, Spellcheck, Delete, Protect Unprotect, Adv, Block commands, Print control commands (advanced).	Installation, Cut and Paste, Thesaurus, Insert a file, Shorthand menu, Tab, Function, Print from keyboard, Merge print, Quick menu, Advance print command	MS-WORD

Whether Wordstar should start first or MS-Word, depends upon the institution. According to experts, some DOS-based wordprocessor should start first.

LOGO-BASIC

Classes				
VI	VII	VIII	IX	X
LOGO	*Elementary Basic*		*Advanced Basic*	
	Flowcharting, Constants and Variables, Arithmetic instructions, Hierarchy of operations, Loop constructions.	Flowcharting, For-Next , While-Wend, Text processing with Basic, Random number, Small programs, Graphics (elementary)	Print statement, Tab and Locate, Print output, Subscript, Variables, Two-dimensional subroutines, Graphics (adv) Animation, Beep and sound.	C

LOTUS-1-2-3/EXCEL

Classes				
VI	VII	VIII	IX	X
			Spreadsheet and its parts, Command menu, Worksheet, Range, Copy, Move, File, Print, Graph, Data.	Installation, Math Calculation, Writing, Functions, Manipulating data, Changing layout, Printing worksheet, Detailed graph, Database management, Import/Export.

Database Management System (dBASE)

Classes				
VI	VII	VIII	IX	X
Introduction to dBASE, What is data? What is the need of managing data? Use of database management in different fields, Packages and languages available for database management	*dBASE (Elementary)* Introduction, Understanding databases, Creating a data-base, Sorting the database 2 Searching the database, Editing and Modifying database, Creating and Printing formatted reports, Managing numbers and data		*dBASE (Advanced)* Designing Custom screen, Displays, Managing multiple Data File, File maintenance and performance, Understanding Memory Variables, Creating Command files, Designing and Developing Programs, Debugging Techniques, Application, Generation, Interface with other packages	Foxpro/ Foxbase

Windows

Classes			
IX	X	XI	XII
DOS	Introduction to Windows Starting Windows, Pull-Down menus, Talking to Windows, Dialog Boxes, Day-to-day file drudgery, Program Manager, Starting Applications, File Manager Basics **	*Installing Windows* Why it is called Windows, Program Manager, Creating new groups and items, File handling, Directory, Disk Drives, Sharing customizing windows, Hard copy Basics **	Working with fonts, Wordprocessing with Write, Paintbrush, Windows, Accessories, Getting wired with terminals, Wielding the DOS six tools, Introduction to Windows for working groups, Troubleshooting common application problems **

** Windows can be started instead of DOS in lower classes and, further, in Classes X, XI and XII, UNIX can replace Windows

MS-WORD

Classes			
IX	X	XI	XII
Wordstar	File functions, Edit, Copy, Paste, Find, Replace, Links, Page layout, Printing commands	Toolbars, Header-footer, Footnotes, Index and Tables, Picture Objects, Database, Spelling, Mail Merge	Formats, Styles, Tabs, Grammar, Thesaurus, Language checking, Envelope and labels, Macro, Customize Export, Import

C

Classes			
IX	X	XI	XII
BASIC	Arithmetic, Array Assignment operators, Break, CASE Compile Menu, Conditionals, Constants, Simple Programs	Derived Classes and Functions, Control structure, Arrays, Matrices, Recursion, Graphs, Tree, Simple Graphics	Strings, File function, Pointers, Structures, Searching and Sorting Queues, Stacks, Graphics (Adv), Music

FOXPRO/FOXBASE

Classes			
IX	X	XI	XII
dBASE	Commonly used Commands and Functions of dBASE, Menus, Windows, Dialogs, Configuring Foxpro, Applications, Print setup, Edit, Database Functions (advanced), Simple Programming	System memory variables, Switching from dBASE, Assembler, Different files, Compiler, Join Condition Loop (advanced) Macros, Report, Label, Text Editing, Programming	Catalog Manager, Compatibility, Trouble Shooting, Object Program Query, Wizard, Graphics, Programming

Professional Packages for Higher Secondary Classes

Classes			
X	*XI and XII*		
	Arts	*Science*	*Commerce*
Windows C FOXPRO MS-WORD LOTUS 1-2-3	Word Processors in Multi-languages, Statistical packages, MS-EXCEL, Coral Draw	Power Builder Engineering and Medical packages	Accounting Packages, Statistical Packages
	(Fundamentals of Networking, INTERNET, INTRANET, Web Designing could be introduced depending upon the facilities available)		
	(Advanced principles of preparing Export Systems and Packages would be added)		

This will be totally optional. One can take one or two packages according to one's interest and stream. Extra marks obtained in computer education which is more than 40 per cent is to be added to the aggregate. For example, suppose a student secured 150/200 marks in computer education. So 150-80 (40%) = 70 marks would be added to the aggregate. (Only positive marks would be added).

Evaluation under the School Experience Programme in the Two-year Bachelor of Education Curriculum

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Abstract

The School Experience Programme is an integral part of the professional preparation of teachers including clinical experiences, experiences of school life, field experiences and teaching-learning processes in order to develop teaching competencies and other skills and knowledge required for the teaching profession. It thus involves three phases—pre-internship, internship and post-internship. The evaluation process and weightage are distributed throughout the three phases under core training, practice teaching, field assignments and post-practice-teaching experiences etc. Systematic training of and orientation to evaluators can bring about validity and objectivity

EFFORTS to improve the quality of teaching in schools depend for their effectiveness on the availability of accurate, detailed and objective evaluations of teaching. Evaluation of teaching may be based on one of the three distinct types of criteria: (*i*) the outcomes of the teaching, (*ii*) the learning behaviours or experiences of pupils that the teaching provides, and (*iii*) the behaviour of the teacher while teaching

By far the largest part of all evaluation of teaching made by supervisors employs the third criterion, teacher behaviour Informal evaluations are based on impressions formed from casual observations of teacher behaviour; formal evaluations are based on observations using some kind of a teacher-rating scale.

It is useful to think of teaching as involving the simultaneous performance of three tasks.

(*i*) Maintaining the classroom learning environment;

(*ii*) Providing learning experiences appropriate to the changing needs of individual pupils; and

(*iii*) Implementing those experiences in which the teacher is an active participant

For convenience, performance of the first task is referred to as "environmental maintenance", the second as "managing learning", and the third as "instructing "

Assessment of teaching is one instance of the assessment of human performance—that is, assessment of purposive human behaviour in the execution of some task. Changes in pupils towards the goals of the system are seen as indicators of good teaching When the criterion is based on in-class behaviour of teachers or pupils, the basis for scoring records is less obvious, but it rests ultimately upon knowledge of what the teacher is trying to accomplish, knowledge available when the task is specified in this way

In practice, most of the evaluation of teaching that goes on in today's schools is process-based, that is based on behaviour of the teacher in the classroom Process assessments use records of how the teacher teaches rather than of the effect that the teaching has on pupils There are two advantages in using teaching behaviour as the criterion for evaluating teaching, the evaluations obtained are diagnostic and they are timely If the quality of a teaching performance is low, it is possible to examine the record to ascertain what the teacher is doing—or failing to do—that makes his or her score so low And this can be done promptly—as soon as the evaluation is complete.

School Experience Programme (SEP) is the new coinage for Internship in Teaching (NCERT, 1991) which is designed to provide opportunities to develop a high level of competence in all aspects of the teacher's work It is an integral part of the professional preparation of a teacher-in-making preceded by successful observation–participation and student-teaching or equivalent clinical experiences in a school environment, and is planned and coordinated by the teacher education institution in cooperation with one or more school systems. The Internship in Teaching or SEP provides multiple opportunities to the prospective teachers/interns to participate in many phases of the work of the school system It is to lead teacher-trainees to the culminating point in their field experiences which comprise observation, teaching and participation in the different activities of the school. A distinctive term has been given to this arrangement to distinguish it from the usual practice teaching by the fact that the student is initiated to first-hand experiences as a teacher in situations closely resembling those in which he/she would be working upon entering the profession (NCERT, 1963) Page and Thomas (1977) consider internship as "probationary period served by newly qualified teachers.. Internship may be in lieu of student teaching" It provides a wide variety of experiences, designed to develop teaching competency such as working with individual students, guiding students, group practice teaching and evaluating students' progress. The teacher training institutions have also to provide experiences in co-curricular activities, effective library service, organization of games and sports, guidance in choice of courses and careers, reporting students' progress, maintenance of record and registers and even aspects like planning for purchase of equipment and apparatus for the laboratory All these require training and experience for professional efficiency as a teacher which are to be provided under the teacher training programme (NCERT, 1991)

Thus through SEP a student-teacher is helped to develop awareness, understanding and knowledge of the best ways in establishing a linkage of a cordial nature among home, school and the community for enriching the life of the secondary school pupils. It emphasizes that besides classroom teaching, prospective teachers under training need to know, exercise and learn how to play their other roles outside the classroom and within the school in order to give them a functional competency and perspective in their roles shouldering the responsibilities required for the job.

In the new teacher-education curriculum, SEP is considered, essentially, a learning process which provides an opportunity and a challenge to the prospective teachers to apply their knowledge of the various subjects and principles and techniques of teaching in real-life situations of the classroom SEP has two very significant parts· planning of student-teaching, and planning of school activities.

Thus the total SEP programme can be classified under three broad phases

(i) *Pre-internship phase* in which the teacher-training institution equips the student-teachers with all the interventions, training, orientation, core-teaching, training in micro-teaching, induction programmes and all the tasks he/she has to perform during his or her placement in cooperating schools.

(ii) *Internship or School Attachment phase* during which the intern has to complete the practice-teaching lessons and gain comprehensive experience of all the aspects of school life as described above under SEP

(iii) *Post-internship phase* includes all those activities which consolidate and provide feedback to training experiences.

The two-year Bachelor of Education curriculum at the secondary stage is based on the Curriculum Framework for Quality Teacher Education brought out by the National Council for Teacher Education (NCTE) in 1998 Through national consultations initiated by the NCTE, a strong consensus emerged in favour of enhancing the duration of the B Ed programme from one year to two years. The new curriculum framework not only transforms the nature and content of the traditional foundation courses but also includes several additional components.

Practice-teaching is now not merely confined to the teaching of certain subjects. It also includes pedagogical analysis of the teaching subjects, need-based pedagogy and transactional strategy, model lessons of different types in actual classroom situations, critical appraisal and evaluation of teaching techniques, observation, supervision, discussion and feedback on each lesson by the supervisor. The practice-teaching, thus, requires thorough preparation, detailed supervision and adequate time Its gain would, obviously, be acquisition of a higher level of teaching competencies

The internship programme is enriched to provide all the experience that a teacher needs. After completion of the period of internship with increased duration, the prospective teacher acquires necessary experiences for working in a school.

Evaluation in SEP/Internship

Srivastava (2000) collected data from 357 interns, 36 teacher-educators, 113 cooperating school teachers, principals, 15 educators, research studies of the past 30 years and concluded that under SEP/ Internship there should be consistent and continuous evaluation of the progress in understanding and developing competencies in teaching Evaluation cannot take place without criticism The student-teacher must be willing to accept suggestions and criticism. The competent supervising teacher or supervisor should offer constructive criticism and suggestions for improvement with full understanding of the ego involvement of the student-teacher Again, there should be mutual acceptance of evaluative suggestions.

Evaluation in student-teaching involves much more than the awarding of grades to the student-teacher and is successful only in so far as the student-teacher himself/ herself accepts and endorses the evaluative results. While evaluating student-teachers' activities the following points should be kept in mind

- Evaluation should be comprehensive Even minor points must be 'observed and suggestions for their improvement must be provided The various tasks and assignments should also be evaluated along with teaching. Weightage to each component of internship such as lesson plan, delivery of lesson, use of teaching aids, interaction with students, performance assessment of students, feedback provided by the intern should be predecided and used in evaluation
- Proper guidelines should be developed for the evaluation of assignments

- Evaluation should be done by a team of evaluators
- Field assignments may be evaluated on the spot.
- Peer evaluation also should be included in the final grading.
- Well-defined and reliable rating scales should be used for evaluation
- Evaluation should be formative as well as summative Supervisors should discuss various points of regular lessons and criticism lessons with interns also. Formative evaluation may be done through regular discussion whereas summative evaluation through assessment of project reports.
- Evaluation should be done against the attainment of the objectives of the field experiences and assignment also.
- Evaluation may be broken down into various competencies to be developed and evaluation may be done against each competency.
- Effective tools should be developed and used for the assessment of core-training, practice-teaching, criticism lesson, final lesson, field assignments, etc
- The criticism lessons should be supervised by a panel of supervisors and cooperating teachers for the full period comprehensively and the performance should be discussed with the interns.
- Five per cent marks may be assigned to self-evaluation
- Marks should be distributed to all the activities of pre-internship, practice-teaching (regular lessons), criticism lessons (in both the teaching subjects), assignments in subjects I and II along with education, assessment by co-operating school principal and teachers, peer evaluation and self-evaluation as shown in the following table.

Distribution of Marks

1. Core training	20%
2 Regular lessons	20%
3. Criticism lesson	10%
4. Final lesson	20%
5 Assignment subject I	5%
6. Assignment subject II	5%
7. Educational assignment	5%
8 Intern's evaluation by principal/teacher of cooperating schools	5%
9. Peer evaluations	5%
10 Self-evaluation	5%

- The final grades should be awarded on the completion of internship i.e the final result sheet should indicate the marks in theory and practice along with the grade the prospective teacher has been awarded after the completion of his/her teaching in a school under the supervision of a mentor Grade should be awarded in consultation with the mentor and cooperating school principal or headmaster The grading may be as follows.

Excellent – A

Good – B
Average – C
Weak – D
Not satisfactory – E

- The average of all the evaluators should be taken for finalization of result and grading.

On the basis of the above mentioned deliberations the following system of evaluation of SEP/internship and related activities can be adopted (RIE, Bhopal, 1999)

First Year (Pre-Internship)
Distribution of Marks Total-150, Pass Marks-60

• Core teaching skill lessons (at least 10 lessons)	50
• Observation of cooperating teacher's lessons	10
• Delivery of at least 10 lessons (five in each subject)	50
• Preparation of Achievement Test	05
• Preparation of Diagnostic Test	05
• Preparation of Report on School Activities and Facilities	05
• Textbook analysis	05
• Practice of unit planning (five units)	10
• Practice of lesson planning (two lessons) during pre-internship training in the college of education	10

Activities

- Supervisors'/Teacher-educators', and cooperating school principals' orientation alongwith at least two subject cooperating teachers' meeting (4+2 days).
- Induction of interns/prospective teachers.
- Orientation in relation to teaching technology, interns' roles and responsibilities
- Training in simulated situations in core teaching skills like (*i*) class management, (*ii*) set induction/introduction, (*iii*) questioning and reinforcement, (*iv*) Explanation and illustration, (*v*) stimulus variation, (*vi*) closure or recapitulation, and (*vii*) integration of skills/macrolessons, etc (Demonstration of macrolessons by teacher-educator/trainer and practice by the trainees. Feedback by the peer group and the educator) (Total marks for Microlessons : 50)
- Training and practice in preparation of teaching aids and blackboard work.
- Demonstration lesson by the teacher-educator in at least two lessons (one in each subject) in real classroom situation. Observation by the trainees followed by discussion
- Training in guidance, counselling and remedial teaching
- Attachment to cooperating schools (at least for two weeks). Observation of school activities and classroom-teaching by the trainees. Preparation of report on school activities and facilities including laboratories, library, sports and games, cultural activities etc. (Marks 5)
- Observation of co-operating teachers' lessons, at least five lessons in each subject (Marks: 5+5 = 10).

- Preparation and administration of at least two achievement tests (one in each subject), and two diagnostic tests (one in each subject (Marks. 5+5 = 10)
- Textbook analysis (one textbook in each subject) and preparation of report (Marks 5).
- Training and practice of unit planning (5) (Marks · 10), and lesson planning (2) (Marks : 5)
- Orientation in case study, school records, admission and examination procedures, result preparation, fee collection (Report to be submitted in the second year after the completion of internship)

Second Year (Internship)

Distribution of Marks Total-350, Pass Marks-140

(i)	*Internship*	
	Regular lessons	120
	Peer observations (at least 20 lessons, 10 in each subject)	20
	Criticism lessons (one in each subject)	40
	Final lessons (one in each subject)	60
	Marks by cooperating teachers/ principal	20
	Unit Tests (two units)	10
	Organization of school activities	10
	Achievement Test and Diagnostic Test	10
	Remedial Teaching (two students)	10
(ii)	*Post-internship*	
	Content-cum-Methods-I	50
	Content-cum-Methods-II	

Activities

(i) Internship

- Orientation for field assignments and projects, etc (one week)
- Organization of meetings of interns, cooperating teacher and principal in the respective cooperating school
- Job and time-table distribution
- Practice teaching (at least 25 lessons in each subject Total . 50 lessons)
- Repetition of lessons should be avoided
- Supervision of lessons, providing feedback discussion on lessons (daily by the supervisors)
- Peer supervision on observation schedule of at least 20 lessons (10 in each subject)
- Evaluation by cooperating teachers/ principal.
- Preparation of unit tests and administering them
- Preparation of progress cards/ records of students.
- Orientation in conducting parent-teacher meetings
- Organization of cocurricular activities (*i.e* , quiz, exhibition, subject club)
- Completion of field assignments under the guidance of the supervisor/cooperating teacher.
- Participation in community work/other programmes of the school
- Preparation of at least two case study reports.
- Preparation of school calendar

(ii) Post-internship

- Post-internship meeting of interns and supervisors to share internship experiences.

- Exhibition of teaching-aids.
- Post-internship subject-wise seminars and discussions.
- Inviting feedback from cooperating schools
- Preparation of brief report by each intern on his/her internship experiences.
- Viva-voce on SEP by a board comprising Science/Languages and Social Sciences and Education faculty members.

Scheme of Examination/Evaluation

Regular Lessons—by supervisors and cooperating teachers

Criticism Lessons—by a board comprising supervisors and subject teacher.

Final Lessons—by a board comprising teacher-educators/supervisors and cooperating teachers/principal

Post-internship—by a board comprising science/languages and social sciences and education faculty members

The evaluation of SEP that goes on in the system is process-based Process assessments use records of how the teacher teaches rather than of the effect that the teaching has on pupils, though the evaluations thus obtained are diagnostic and timely The principal drawback in process-based teacher evaluation is that the evaluation lacks the validity intrinsic to outcomes-based evaluations. The validity of process assessments depends on the amount of reliable knowledge of the nature of effective teaching behaviour available. The process records are scored mainly to reflect someone's best judgement rather than verified research findings

The assessment of practice-teaching/SEP for the purposes of certification is a problematic subject. To a great extent it is the consequence of the apprenticeship approach. Student-teachers are graded according to the criteria held by individual teachers or specific institutions and the criteria have not always been made explicit (Stones and Morris, 1970, Wiseman and Start, 1965, McCulloch, 1979)

In attempts to introduce a degree of rigour and objectivity into the assessment of practice teaching/SEP, schedules have been produced by the teacher training institutions. These schedules itemize those aspects of teaching performance thought to be critical in satisfactory teaching. Student-teachers are awarded marks on a scale for each aspect by supervisors or cooperating teachers

While devising of check-lists against which to evaluate student-teaching is a move towards objectifying the process of assessment, scrutiny of the schedules available reveals some problems Their discrepant nature illustrates the lack of clarity and consensus in the nature of the desirable criteria of practice-teaching. Further, the awarding of marks on a scale for each item on the schedule is in most cases extraordinarily difficult and depends a great deal on the assessor's ideas and values It is possible, by systematic training, to get assessors to grade student-teachers similarly, that is, award them roughly the same marks on each item of the schedule thus providing marker consistency

The present course organization with the clearly demarcated practice teaching, SEP attachments to school, organized and conducted in separate compartments from theoretical studies, signals to students that the two activities are distinct and preserve the archetypical conception of student-teaching as apprentice training.

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Computer-based Advanced Technologies in Education

Developments, Challenges and Opportunities

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Abstract

The advances in computer technology and communication technology have revolutionized the educational system. They have changed the style of learning, teaching, communicating and gaining access to information. The advantages have compelled us to change our present style of schooling. This article describes the need and the changes occurring due to the developments in computer-based technology in our educational system. The historical and modern developments in this direction along with their salient features and achievements have been presented. It also discusses the issues, challenges and opportunities that arise with the introduction of computer-based technology in Indian school education

COMMUNICATION is education and education is knowledge. This is an age of knowledge explosion and exploration Rapid progress in computer technology has invaded the educational arena Over the last few decades, computers and communication technologies have had a significant impact on the ways in which we learn, teach, communicate and gain access to information The educational technology now available enables courseware designers to move away from the usual 'linear learning paradigm' to 'non-linear learning ' Multimedia courseware exploits the role of multisensory perceptions in the learning process. The developments in educational technology have made educators, courseware developers and pedagogues redefine the elements of education Earlier, computers in education concentrated on individual instruction involving Computer Assisted Instruction (CAI). But the recent developments in educational technology call for a more holistic and integrated models and approaches to the educational process The new instructional technologies have brought about changes in pedagogy and curriculum content, and have been instrumental in increased academic productivity and teaching effectiveness. Techniques like electronic lectures, collaborative learning and teaching, teleteaching, student self-assessment through automated interactive online testing, use of digital resource libraries, and access to the Internet and the World Wide Web are the educational tools and techniques of the future.

Historical Developments

Historically, there have been four significant advances to facilitate knowledge transfer. They are· development of various aids to facilitate reading and writing activities, printing and photocopying for mass distribution of information, radio and TV broadcasting for global dissemination of non-interactive, non-print materials, and the use of computers for the realization of interactive information systems For better understanding and retention, information must be properly structured, organized, managed and processed, to mould the learners' thought processes Computer technology in the form of CAI helps better in this direction, compared to that prescribed by the teacher.

Modern Developments

The online classroom through computer-mediated communications in the form of electronic message just simulates the traditional blackboard It is of four types. (1) Simple electronic mail it is one person to another person communication At the receiving end, even if the person is absent, the information will be stored in his/her terminal which can be accessed at any time. (2) E-mail distribution lists· here, one person can send information to many people simultaneously. (3) Accessing on-line resources. here a person can get in contact with a remote source of information Thus, the information from many sources goes to one person. (4) Computer-mediated conferencing system . it is a network where, many people can interact with many others. It helps in discussion

The introduction of interactive video-communication, teleconferencing, online discussions on Internet, CD-ROMs, Multimedia, Virtual classroom, Split-Site courses, video desktops, etc. provide interesting applications in both formal and non-formal educational streams. Creation of new course materials, conversational learning in electronic form, interaction through E-mail, voice-mail, video conferencing, bulletin boards, electronic conference on the Internet are the order of the day. Resources available on the Internet and other information networks cannot only replace a considerable portion of classroom teaching, but can also improve the quality of perception and the level of comprehension in the quest for knowledge through various computer applications Information highways have brought people together and one can communicate at a much faster pace and in a better way across the globe. In fact, we are moving towards a global village People can 'meet' each other on the net It has brought large storehouses of knowledge and libraries within living rooms and is instantly available at any time It has also reduced the cost and time involved for the same activity It facilitates effective sharing of experiences and innovations It also facilitates inventions by making key inputs like information, expertise, methodology and techniques available to the researchers It has converted a teacher from an instructor to a facilitator and coach It has improved students' creative thinking, analytical skills, collaborative approaches and integrative approaches

Salient Features

The multimedia courseware development and deployment are astounding and innovative The salient aspects of the state-of-the-art in multimedia courseware and instructional technology are given below At the outset, it is available for nearly all age groups, ranging from pre-school children to adult learners It attracts the learner as it employs a rich array of media elements from 2D and 3D animations to voice scripts, to video Apart from this, it provides reasonable scope for self-assessment and feedback Moreover, it is deployed on CD-ROMs which are compact and easy to handle. Myriad tools are available with capability to create rich and striking media effects in an economical manner, mainly in terms of time and money. Powerful authoring tools available today, enable tying up of pieces of media elements into a cohesive courseware. Major advances in networking and communication have enabled development of enterprising products that bring the concept of 'Groupware' to the learning domain Courseware employing just a few media elements have steadily crept their way into the now increasingly popular Internet through plain Hyper Text Mark-up Language (HTML) or through innovative Java and C^{++} applets The major advantage that learning derives from deployment of courseware on the Internet is the capability to provide 'non-linear learning' in an easy and uncomplicated manner The recent innovative plug-ins for Internet browsers that enable delivery of all the media elements make multimedia courseware deployment on the Internet a viable proposition Even more exciting are the newest versions of macromedia authorware and macromedia director, that enable all the courseware that have been authored using them, to be directly deployed on the Internet. The Lotus learning space is an exciting software that harnesses the rich Groupware capabilities of lotus notes, the multimedia components of the courseware, and even the backend needs of managing a learning centre, school or university.

Achievements

Although multimedia courseware development and deployment are exciting and versatile, the developments in Instructional Technology are not so spectacular. Most educators agree that linear learning may not be the best and that, courseware must provide for non-linear learning. Most courseware provide for some form of controlled non-linear learning. Many even provide for some navigation aids so that the learner does not become disoriented due to excessive use of non-linear jumps School and college education primarily rely on the assumption that the population of students being taught is reasonably homogeneous This assumption is perhaps valid to some extent in select schools and colleges, where admission is based on test and interview But, in a majority of the schools and colleges, student-heterogeneity prevails This implies that some form of person-centered education is desirable. Instruction technology, today, is far from achieving this goal It is but an elementary principle of learning that one does not want to be taught what one knows already Instruction technology has just begun to recognise this very important requirement Evaluation and feedback are vital in any learning methodology Instructional technology has just begun to grapple with this issue, which has been traditionally swamped by multiple-choice questions The current trend in instructional technology leading to multimedia courseware is to produce dramatic visual and auditory effects, exploiting the multimedia capabilities of modern computers Its correlation to learning is not properly understood

Issues

Issues based on educational technology, pedagogy, sociological and psychological aspects clamour for attention when we consider multimedia courseware and instructional technology Given below are some of these issues. Can multimedia courseware replace the teacher?. This question is akin to the question, 'can machines be made to think?. Multimedia courseware tends to work excellently while working in areas where skills and procedures are predominant. They are not so effective where conceptual learning is involved. Therefore, it would be pragmatic to let multimedia courseware provide learning for the skills and procedures domain, while the quintessential teachers still hold the reins of conceptual learning. The learning methodology of children and adolescents tends to be vastly different from that of adults The courseware must recognize this fundamental difference. There is little point in having fancy graphics and cartoon characters guiding the way in a courseware for adults A case in point is the 'Office Assistant' in office 97 suite of Microsoft. Most adult learners tire of this feature and find it immensely distracting Assessment and feedback are essential aspects of the learning process, although for most learners they are dreaded entities. This issue is to ensure the quality and reliability of the assessment and feedback process Unfortunately, most of the courseware tend to pay little or no attention to this vital aspect of learning It is well recognized that interaction is a necessary component for learning in many areas. This is a much misunderstood and abused terminology. Interaction implies more than mere 'mouse clicking' or elementary keyboard input from the learner It means exchange of ideas between the teacher and the learner, and among members of the learner peer group In what manner is person-centered learning provided for in the courseware? At the bare minimum, the courseware must provide for ways that a person need not learn things that he already knows. It could go beyond to allowing a person to choose the domain of learning and the pace of learning It could provide for means of learning based on one's primary strengths, while constantly honing up the areas in which one lags behind. The issue is to make the courseware as custom-built as possible while still retaining some of the generic learning requirements.

Challenges

One of the major concerns of educators today is that in attempting to meet the growing demands for learning, several educational entities have sprung up, while the quest for quality assurance remains a distant dream. How multimedia courseware measures to this challenge remains an absorbing area of research Many thousand years ago in India, the *gurukul* system advocated that a student be first assessed by the teacher for specific competencies After this the teacher would chart out a preferred roadmap for learning, tailor-made to suit the requirement of the student. In the staggering pace of growth and modernization, this system was nearly lost to society Today, educational and instructional technology affords us a tantalizing glimpse of achieving what we had achieved many thousand years ago The tremendous scope of the multimedia courseware for web-based education is often stressed, but with a note of caution. Traditional methods of delivery have been through CD-ROMs Educational psychologists have been concerned about the possibility of isolation of learners and losing the value accorded by peer group interaction With vast advances being made in communication, networking and the Internet, the benefits of delivering multimedia courseware on the Internet become significant The demand for education often outstrips the supply of quality courseware. The turnaround time for the production of multimedia courseware has been rather long, not capable of meeting the staggering demand Hence, there is need to evolve systems, procedures and tools to reduce the turnaround time for the production of courseware from months to weeks The virtual educational system concept, does not sound anymore like a distant dream, but could be a reality in the very near future.

Opportunities

A thorough examination of 'cyber future' projects the following possibilities in the field of education. The education experience will be dramatically enhanced by multimedia, computer simulation, virtual reality and other teaching tools. There will be a boom in packaged educational products The tremendous increase in knowledge available in libraries and databases will bring to the forefront the critical question as to what a student really needs to learn An incredible amount of information will be available to students writing their term papers. A global educational system will emerge, bringing together students and faculty from many nations via computer networks, satellite television and other such advancements. Infotech alone will not ensure good education Teachers will continue to be needed. The teachers may resist infotech in education when it threatens their jobs and privileges Infotech will allow students to take courses at their own pace and get credit whenever they have mastered the material.

The growth of the computer industry—hardware, software tools, communications and networking—offer exciting possibilities The list of innovations that one could work on seems fairly endless India is endowed with one of the largest trained and skilled manpower resource in computer, communication and information technology However, educational technology in India still has a long way to go to reach the levels attained by many advanced countries. Japanese technology has introduced some of the educational technology devices such as laser video disc player and recorder, National language processor, speech synthesizer and robotic talking computer, which are useful, novel interactive learning devices in science teaching and research

Basic infrastructure and supportive sub-systems need considerable strengthening. New experiments, creative innovations and appropriate strategies have to be developed and tried out to improve access to education, to reorient the content and to renew, reinvigorate and revitalize the entire system of education through the application of the latest and most sophisticated educational technology and media. There is an urgent need to create a real virtual campus for effective teaching and learning. Tomorrow's economy will revolve around innovatively assembled brain-power Hence, the knowledge networks would be a major step forward in gearing the schools and universities to meet the national priorities and growth needs.

English Language Proficiency of Students in Different English Language Teaching Systems

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Abstract

Resurrecting the falling standards of English in India, especially in the current era of globalization, has been an important preoccupation of researches in English Language Teaching The present investigation has made an attempt to study how English language proficiency of students gets affected when studying in an innovative system of school education. In the four skills—listening, speaking, reading and writing—it was found that students in the innovative system performed significantly well in all the four skills. The study strongly supports the use of innovative techniques in improving the English language proficiency of students.

LANGUAGE is an essential part of human life. There are many languages spoken in different countries of the world but English has acquired a prominent place in meeting the communicational needs of the people. It is now more than ever that English has become a language of opportunity and advancement

The United Nations Organization has given English the status of official language F.G. French's statement seems quite apt. "No language ancient or modern can be compared with English in the number of geographical distributions of the homes, factories and offices in which the language is spoken, written or read." These days, every country is mutually dependent on other countries in political, social, economical and cultural matters Here, again, English serves as an important link language.

The Secondary Education Commission, 1953-54 shed light on the importance of English : "Our youth should acquire knowledge from all sources and contribute their share to its expansion and development. In the attainment of this objective, study of English is bound to play an important part.. ." The Chief Ministers' Conference, 1961, concluded, "English should be taught along with Hindi in order to get outside affairs for All India Services, for engineering medical and forest departments." Successive National Policies on Education (1968, 1979 and 1986) have given importance to the study of English language

Keeping in view the importance of English, a deserving place should be assigned to this language in the school curriculum. However, it is a highly disturbing trend that standards of teaching and learning English have definitely fallen in the country. It is, therefore, important that innovative methods of teaching the language are tried out to raise the standards of teaching English in the country This also implies that different systems of education and their impact on the linguistic abilities of students should be studied.

Research Paradigm

The study was designed to compare two equated samples of students —one studying in the traditional system of school education and the other in the innovative system.

Traditional System

The system of education prevailing in high schools affiliated to the U.P. Board are characterized by an annual system of examinations conducted mainly through written mode consisting of essay type of items. The teaching methods are accordingly textbook-oriented and focussed on reading and writing alone.

Innovative System

In contrast, the innovative system of education refers to the semester system with new techniques of teaching and evaluation like seminars, group discussions, periodical assessments (objective type of tests) and emphasis on co-curricular activities for all-round development of students. Thus emphasis is not only on written but also on oral English.

Tools of the Study

For this study the investigator constructed a comprehensive language proficiency test battery, comprising the following four tests.

1 Test of listening skills
2. Test of speaking skills
3. Test of reading skills
4 Test of writing skills

To compare the English language proficiency of students studying in the innovative and traditional systems, the investigator administered each of these four tests on a representative sample of 80 students that consisted of 40 girls from each type of institution, innovative and traditional The two groups were equated along several dimensions e g socio-economic status, age, sex, class and the overall performance of students of the school in academic and non-academic areas

Findings and Discussions

The evaluation of the tests was done by two examiners and their mean scores were taken into consideration for analysis. For each of the skills of listening, speaking, reading and writing the mean performance of students was calculated for the two groups separately Therefore, the means of the two groups were compared by calculating the critical ratio and finding out the *t* value Students of both the systems were found to exhibit the same level of proficiency only in one skill, viz. listening In all the other skills i.e. speaking, reading and writing the performance of the students in the innovative system was found to be significantly higher. Following is a skill-wise discussion of the results.

Listening Skill

A short story and a few sentences expressing different moods were played on a tape-recorder The students were required to first listen to them carefully to answer the questions based on the story, and second to identify the stressed words and statements of different moods Students were evaluated for the following seven sub-skills of the listening skill

(i) Stress
(ii) Intonation
(iii) Substance
(iv) Ideas
(v) Word meaning
(vi) Relationship
(vii) Sequence.

The mean scores of each component skill were calculated and it was found that there was significant difference between the two systems of education (Table 1; Figure 1).

TABLE 1

S No	*Group*	*Mean*	*t-value*	*Significance at 0 01 level*
1	Innovative	12 12	0.19	Not significant
2	Traditional	12.05		

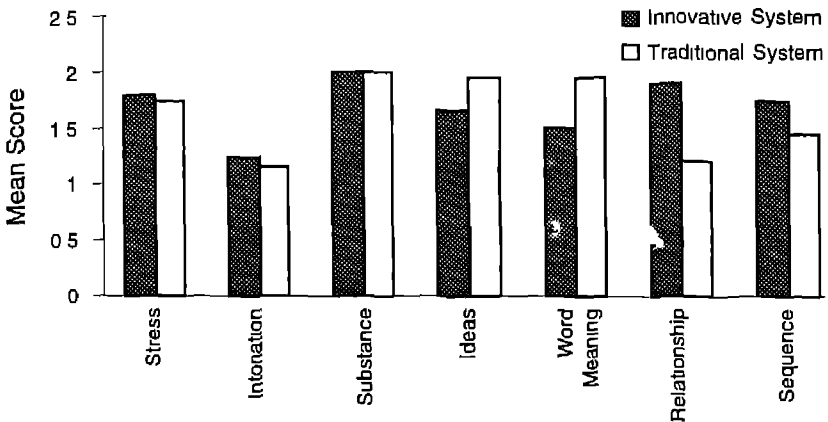

Fig. 1 · *Mean scores of the listening skill under innovative and traditional systems*

This indicates that classroom teaching is not the only source for giving students practice in listening. There are many other media through which they get sufficient exposure to spoken English language. Television news, recreation programmes, commentaries on the radio, movies, English songs, etc. are different examples of exposure to spoken English which are enjoyed by students outside the school. This has certainly increased their receptive capabilities in spoken English, thus neutralizing the effect of different school systems

Speaking Skill

The speaking skill was evaluated on the basis of a short oral test comprising two tasks The students were required to first read out a given dialogue using suitable stress and intonation and secondly to describe a given picture in five to six sentences. The performances of the students were evaluated for the following six sub-skills of spoken English.

(i) Pronunciation
(ii) Vocabulary
(iii) Structure
(iv) General fluency
(v) Sequence
(vi) Stress intonation

It was found that students in the innovative system performed better than students in the traditional system in all the six components of the speaking skill. The traditional system is purely based on the written aspect, whereas in the innovative system's group discussions and seminars a presentation is a vital aspect of daily classroom teaching. Hence, there is much greater exposure to and practice in spoken English in this system Almost every week students get the opportunity to give seminar presentations and to carry out discussions related to their course topics.

The mean score of each component skill of the speaking skill was calculated (Table 2; Figure 2)

Due to more opportunities for oral

TABLE 2

S.No	*Group*	*Mean*	*t-value*	*Significance at 0.01 level*
1	Innovative	18.45	6.21	Significant
2.	Traditional	13.85		

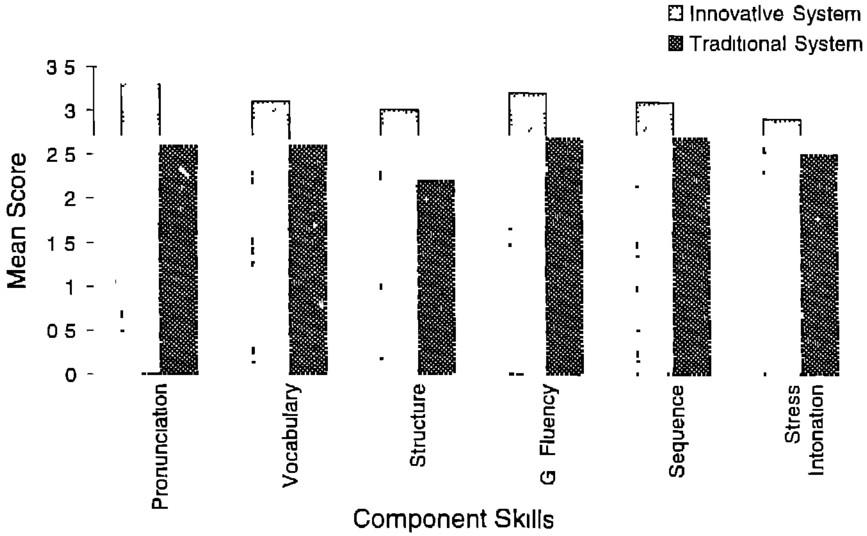

Fig. 2 · *Mean scores of the speaking skill under innovative and traditional systems*

presentation and expression more perfection in spoken language is acquired in the innovative system

Reading Skill

To evaluate the reading skill the students were given a short test comprising a short paragraph and questions based on that paragraph. The students were asked to tick the correct answer out of five alternatives given for each question. The students were evaluated for the following eleven sub-skills of reading in English.

(i) Words and phrases
(ii) Facts and ideas
(iii) Locating key words
(iv) Relationships
(v) Sequence
(vi) Comparisons
(vii) Interpretation
(viii) Inferring meaning
(ix) Inferring mood
(x) Central idea
(xi) Evaluation.

The mean score of each component skill of the reading skill was calculated (Table 3; Figure 3).

The better performance of students in the innovative system may be due to several reasons. One factor is that in this system evaluation is done more frequently and, therefore, students are more regular in their studies resulting in better performance Moreover, in the innovative system, the variety of questions such as objective type, short-answer type, seminar topics, etc. affect the reading ability. In order to answer such questions based on the text students have to depend on their own ability to comprehend rather than on guide books available in the market.

Deficiency in the reading skill among the students in the traditional system may be attributed to two chief defects of the system, namely, lack of continuous evaluation and heavy dependence on essay-type questions for assessment of the reading ability The latter defect has been encashed by the 'bazaar' notes which flood the market and encourage the students to cram up answers without actually understanding the original text.

TABLE 3

S No	*Group*	*Mean*	*t-value*	*Significance at 0 01 level*
1	Innovative	6 52	4 25	Significant
2	Traditional	4.82		

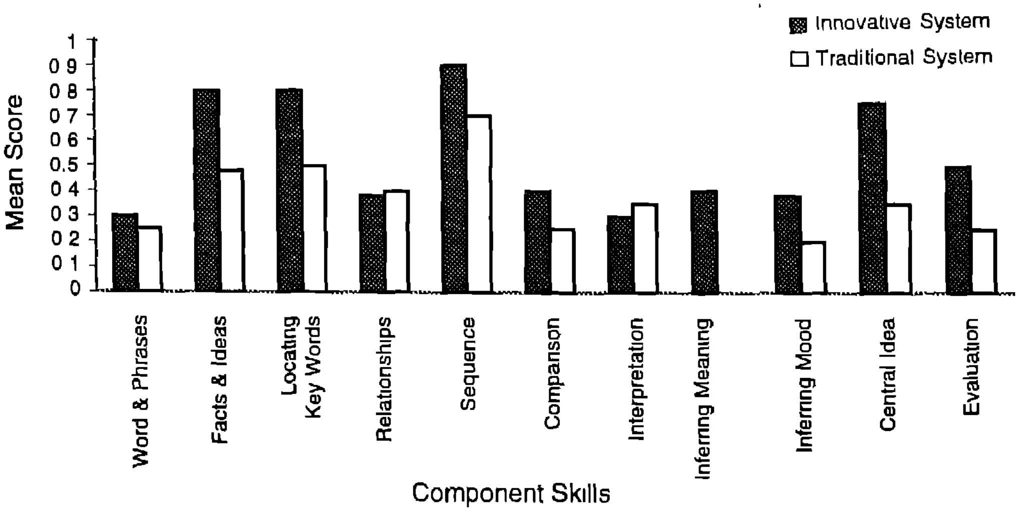

Fig. 3 : *Mean scores of the reading skill under innovative and traditional systems*

Writing Skill

To evaluate the writing skill of the students of the two systems they were asked to write a composition on one topic in about 150 words introducing the topic, dividing the body into paragraphs and then concluding it. The composition was evaluated for the following seven sub-skills of the writing skill.

(i) Structure
(ii) Relevance
(iii) Vocabulary
(iv) Spelling
(v) Organization
(vi) Imagination
(vii) Handwriting.

Mean scores of the component skills of the writing skill were calculated and it was found that students in the innovative system performed better than students in the traditional system in all the components of the writing skill(Table 4, Figure 4).

There could be several reasons for these results. The students in the

TABLE 4

S No.	*Group*	*Mean*	*t-value*	*Significance at 0.01 level*
1.	Innovative	18.65	4.30	Significant
2	Traditional	13.92		

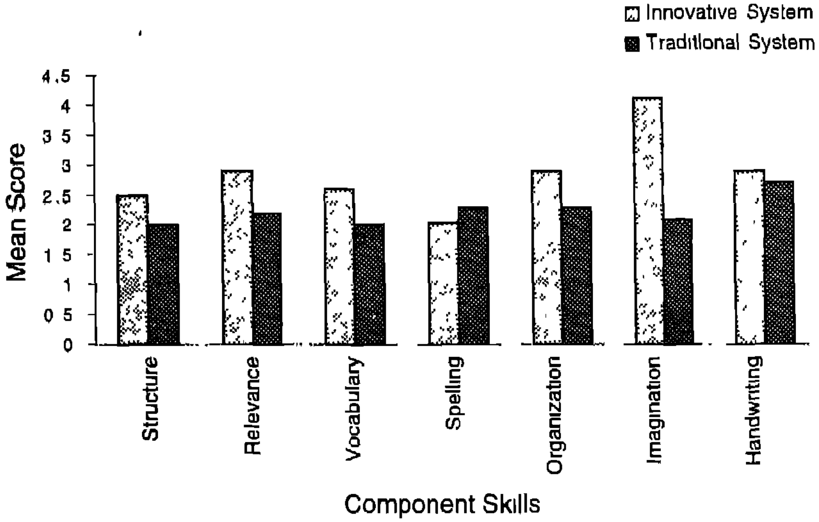

Fig. 4 · *Mean scores of the writing skill under innovative and traditional systems*

innovative system undergo continuous evaluation under this system Written assignments are given in the form of class assignments, home assignments, class tests and open-ended questions in quiz tests, etc. More chances are provided to them to express themselves in written form resulting in better writing performance as compared to the traditional system. In the traditional system the students are not given enough practice and chance to express themselves. The homework is not taken seriously by the students because the marks are not added in the final mark-sheet. So they just take the help of a guide or other materials and tend to finish them hurriedly as this has no significance for them Moreover, set types of questions are repeated again and again and so students in the traditional system generally just cram the material available to them In the innovative system the students get to know their weaknesses from time to time which they remove gradually adding perfection to their writing skill

Educational Implications

1 The traditional pattern of language education based essentially only on class lectures will be enriched with the addition of seminars and group discussions which would enhance the oral skills of the students.

2 The evaluation system should be continuous rather than terminal in nature and some amount of weightage should be given to internal exams in the traditional system. For example, in home science, music and science subjects sessional files are shown to external examiners, likewise, in English also sessional files can be maintained and given weightage in the final examination.

3 Emphasis should also be given to extra-curricular activities conducted in the English language, so that students have a good command over the language, both spoken and written

Improvement in the nature of evaluation items by inclusion of short-answer and objective-type items in the form of quiz tests will help the students to go beyond memorization of essay-type answers based on the text This will substantially improve their reading (comprehension) ability

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Resensitizing Education-situating Learning in Context

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Abstract

It is no longer contested whether culture creates mind. Construction of knowledge is essentially a cultural process embedded in the texture of traditions. Imparting decontextualized and compartmentalized information in an impersonal manner, fails to create "enabling learning environments" and alienates children. Against the monolith of universal (national) curriculum it is posited that curriculum essentially be derived from the cultural contexts of people. Emphasizing the primacy of culture as a pedagogical issue and as a means to situating education in the context of learners, it is argued that curriculum be considered as a cultural script rather than a universal, sacred text. The article draws its conceptual framework from the socio-cultural perspective in cognitive psychology in general, and Jerome Bruner's ideas about "Culture of Education" in particular.

IN recent times, the educational truths are afflicted by antinomies Resolution of complexities arising out of these antinomies is not an easy task as these are typically the outcome of social complexities and contradictory realities that the world is facing. The issues involved warrant thoughtful cogitation at different levels of analysis Globalization, liberal economy, information systems etc are the key words today and education for the twenty-first century is the priority agenda. Federal and State bodies of education have assumed the task of redefining education in the light of demands expected in the next century However, millennia are not discrete periods in history and slogans alone do not change reality. India marches into the twenty-first century with a shamefully high rate of illiteracy Nearly 50 per cent of its children are out of school. Education as a means of social development has also caused 'underdevelopment' The divide between the developed and the underdeveloped has widened.

India, which followed the British model of education after Independence, enriched its educational system, whenever it did, by addition of tools and techniques imported from the West The basic character of education has remained unchanged Despite our rich and divergent cultural past and present, we have chosen to continue with the legacy left behind by the colonizers With full cognizance that they had a specific agenda in mind, we somehow continue to put our energies in "Macaulay's mill" We seem to have lost faith in our abilities to think rationally and act purposefully By basing our education on Euro-western ideas and contemplating learning and teaching accordingly, we have created a serious conflict of which our child is a victim. How long do we want to burden our children's mind by teaching them in a language which is not theirs, by giving them content to which they cannot relate. Recent research on illiteracy and dropout indicates that, while poverty is a deterrent, majority of the children do not go to school because of the meaninglessness and irrelevance of school curriculum for them. Education needs to be sensitized to the needs of the masses and requires to be essentially situated in their contexts. Education has to squarely face the antinomy of meaningful education imparted in one's own language and learning disembedded content in an alien language so as to become a part of the global culture

The implicit assumption in this epistemological tradition is that there are abstract universals of knowledge, which can be meaningfully learned by didactic exposure Isomorphism between external reality and internal representation is assumed to exist. Logical positivism guides research and practice in education. Such a system emphasizes that learning of prepositional knowledge (declarative) will automatically lead to the acquisition of procedural knowledge. What is learnt in school in disembedded form will suffice to solve problems embedded in real contexts. It further assumes that transfer of knowledge from abstract to concrete, from one situation to another, automatically follows. The mastery of declarative knowledge is a sufficient condition for developing skills for situated problem solving Thus what the child experiences in school is a kind of learning which generally does not make contact with real-life situations. The constant challenge then for the learner is to situate knowledge in living contexts

The cognitive revolution, which began in the 1960s, vowed to 're-throne' mind in "mindless psychology" (behaviourist psychology), but the kind of mind which got transplanted, led to a condition worse than not having one The 'new mind' was suffocatingly mechanistic and "worked like computers " It supposedly processed information in an unambiguous manner, and not as any 'organic entity', engaged in the process of meaning-making in amorphous, ambiguous, chaotic situations Consequently, much of the modern research and theorizing in the field of learning was conceived according to the computer metaphor. The computational model of mind assumes that knowledge is finite, describable according to some fixed categories and knowledge of the world can be interpreted according to these categories. Learning, then, is a matter of fitting experiences into these categories. Knowledge, thus, is assumed to be constructed in monolithic ways because the pre-determined structure of information processing limits the ways in which knowledge can be processed The focus of education is therefore identification of entities, relations and attributes that learners "must know." Such a view is antagonistic to variability—antithetical to the concept of cultural diversity. It certainly can explain processing of well-formed information but it should not be forgotten that computers have 'lexicons' and not 'contexticons ' Therefore, the infinite number of possible meanings of the same word that contextual differences might generate cannot be managed or even explained by such systems. This, however, does not mean that the meanings constructed in different situations by the same or different individuals are essentially idiosyncratic but emphasizes that they are consensual Culture creates its own semiosis—the process of creating sign systems and negotiating meanings. Therefore, there are culturally sponsored ways of meaning-making Every culture provides its members with both, material and psychological tools, which determine construal of shared reality. The processes of meaning-making together with concepts of culture, define epistemological traditions of that culture. The meaning is communicable to the child in a manner that reflects cultural epistemology and the child spontaneously or unconsciously takes to these ways of constructing knowledge. They get tuned; culturally programmed, to interpret the world accordingly. Attempts to understand non-native ideas using "native mental structures" not only make heavy demands on cognitive processing but may also render the whole experience meaningless "Education needs to be skeptical regarding any notion of reason that purports to reveal truth by denying its own historical construction and ideological principles " (Giroux, 1996)

Knowing and communicating are the two sides of the same coin One communicates what one knows, which is surely in the mind, but what one knows, has its genesis in culture. Therefore communication is not culture-free. Culture's language is not just a medium of communication but also a phenomenon, which is inextricably intertwined with thought processes. Though culture itself is man-made, it forms and makes possible the working of a distinctly human mind. Thinking and learning are always situated in a cultural setting and are essentially dependent upon utilization of cultural resources Education in India, which speaks the language of the English or of the dominant class of the country, displaces people from their residence (culture), which is a source of their identity. There certainly is an identity crisis in our country

The 'culturalist' view of cognition picked up full momentum in the 1990s. There is enough research today to suggest that there are no domain-general universal knowledge structures, which cut across task, content and situations However, there may be Central Conceptual Structures (as suggested by neo-Piagetians) in each domain, which develop from specific to general. Cognitive abilities can therefore be seen as context-embedded skills. Though decontextualization of knowledge gradually occurs, it comes quite late, perhaps after schooling, when the individual actually experiences the related contexts. Experience with similar contexts leads to general understanding of the phenomenon, resulting in the development of Central Conceptual Structures Thus, the route of development of general cognitive structures is considered to be the opposite of what Piaget has suggested. Such a view points to the need to situate learning in contexts that are personally meaningful to learners

Another related, long held belief is that learning is intrapsychic, solo, wherein a child constructs knowledge unassisted Recent thought and research challenge this view It has become increasingly clear that learning is an interpsychic activity and psychological and material tools of culture mediate knowledge. "However much the individual may seem to operate on his or her own, in carrying out the quest for meanings, it cannot be done unaided by the culture's symbolic system" (Bruner, 1998). It is the culture that provides the tools for organizing and understanding our worlds in communicable ways There is no natural, culture-free mind. Mind is essentially dependent on the culture's 'tool kit' for construction of reality "All knowledge of the world is mediated through signs, which are jointly determined by the physical world and cognizing organism" (Cunningham, 1987, 1992) Like how one creates something cannot be described without referring to what is used for construction, how the mind constructs reality cannot be explained without referring to the tools available to the mind "Knowledge is institutionalized in folklore, in myth, in historical records, eventually in libraries, constitution and now on hard disks" (Bruner, 1997). However, what is stored on the hard disk and what prescription it provides for how to think, differs from culture to culture

Introduction of new material tools does not necessarily change the culture's "prosthetic-devices"—culturally devised ways of thinking, searching, planning, and believing Functioning of the mind cannot be explained without reference to culture. It is illustrative to note that a genetic engineering scholar in India consulted an astrologer regarding the auspicious time for submission of his research thesis. Such instances are not rare There are religious websites on the Internet with icons of Gods who are worshipped in the most modern style. There are compact discs, which chant ancient "mantras", and hymns in the praise of God Helipads are being constructed on mountains to facilitate quick and comfortable pilgrimage. Close-circuit TVs have been installed in many temples in the country to provide a better view of deities to the people who throng in large numbers A survey conducted in five metropolises of India indicated that 94 per cent of teenagers believed in God and 86 per cent categorized themselves as very religious (Jain, 98). Science has indeed made different forms of religious activities accessible with greater ease One can import material tools but whether these tools alter culture's prosthetic devices is a matter worth considering. Mind is essentially the creation of culture. It not only structures mind but also imposes limits on how it functions Can culture be treated as an independent variable?

Epistemological traditions, which consider culture as a source of variance to the general norm, are not found tenable according to the culturalist view. The culturalist view considers culture as a constituent of mind, there are no 'naked' minds as universal theories assume Culture is both, a resource as well as a constraint on mental functioning. Culture and biology both impose constraints on human functioning However, body and mind both are malleable, progressive and ever evolving. Humans do things, which their phylogeny, directly, never prepared them for With the use of tools created by culture, man can 'fly', 'run' at tremendous speeds, and do other things not prescribed by phylogenetic characteristics As material tools enhance bodily functions, culture's psychological tools enhance mental functions Interaction of human body and brain with the world is a creative process *Homo sapiens* have evolved, so have cultures With more and more intellectual sophistication in society, mind is evolving faster than perhaps the rest of the body. The physical characteristics of the stone-age man can surely not be compared with those of modern man Likewise, the brain of today's man is far too complicated as compared to the brain of early man. There is a strong belief that the origin of complex intellect, which characterizes contemporary man, originated in the complexities of a socio-cultural milieu

Culture has, therefore, the tremendous potential of building up the mental capacities of its members, both in terms of providing new thought structures, prosthetic devices (psychological tools), as well as physical or technological tools for enhancing cognitive and physical functioning of its members. Computing aids, computers, to mention a few recent tools, not only enhance the functioning of individuals within the common range of physical abilities but also aid individuals who are different with respect to physical abilities. Society also develops special tools for individuals who are different from the majority of the population. Learning culture should be 'enabling' for all kinds of individuals who differ with respect to physical, mental and social capabilities. Braille and hearing-aids are examples of tools which societies have created to enable their members to benefit from their life experiences, to make their interaction with the world more fruitful Also, linguistic codes which culture uses to address these individuals communicates how to think about them, what to expect from them and how to treat them Disability is a social construct. For instance, if our folklore, literature, media, etc. project the physically and mentally challenged as subjects of comedy, a negative message is communicated to the younger members of the society Furthermore, as long as we have special schools for those who can benefit from normal schools, disability will remain a special category. Such a context is more crippling than enabling for individuals with a difference. Society is expected to address the needs of all. Culture is a resource as it provides its members with tools and ways of constructing reality It enables individuals to interact with the physical and the social world and therefore "enabling cultures" are more conducive to the development of individuals. Mental activity is situated in and supported by more or less enabling cultural settings

"The culture's symbolic tool kit actualizes the learner's very capacities. Mental development is principally and inevitably interpersonal" (Bruner, 1997) Construction of knowledge is essentially a cultural process, which is embedded in the texture of traditions. We not only possess the language which provides a rationale for thought and action but also concepts and vocabularies of description and explanation for what is experienced We get culturally programmed to confronting life situations with codes in mind, with forestructures of interpreting reality Traditions, the tools of culture, shape the lives of the young preparing them for shared and communal living. There is tremendous diversity in the 'tools' different cultures use and the mind is accordingly programmed It is therefore essential that the early education of the child should emerge from native culture rooted in its folk pedagogy If learning is situated, embedded in context, then can there be a model of education that is universal—monolithic? India is a multi-cultural society with tremendous cultural diversity Majority of India is rural and linguistically plural. There are hundreds of spoken languages with many more dialects A State-controlled curriculum transacted in a few dominant languages fails to provide 'enabling learning culture.' The issue of medium of instruction has too serious implications to be ignored.

"Hundred years of industrial capitalism in India has not been able to homogenize marked divergences. There are innumerable linguistic communities with their cultural moorings embedded in their customs, rituals, institutions, needs, luxuries, production processes, consumption patterns and property relations" (Wahi, 98). How can then a monolithic model serve such a vast diversity? More importantly, why should there be a monolithic model? This violates the fundamental nature of the phenomenon in question. Furthermore, in the vast cultural and linguistic diversities are embedded diverse epistemological traditions intimately interwoven in the cultural texture. The principle of uniformity would not only eventually bury the diverse wisdom and intellectual traditions but will also render educational reforms meaningless Claims to objectivity, therefore, cannot be over-stressed. Instead, epistemologies which acknowledge the historical and socially constructed nature of knowledge, should be favoured. Curriculum could thus be viewed as a cultural script conveying a particular form of reason It should be clear that the question here is not one of adjusting teaching to backgrounds, abilities, styles and interests of students but to consider ways in which learners' minds are conventionally programmed and adopting pedagogical practices that flow from these ways of thinking about mind.

In view of the vast cultural diversity of our country and the revolutionary times through which the country is passing such as are characterized by drastic changes in demography, family structure, ethnic awareness and socio-economic opportunities, the antinomies in education become increasingly glaring Centrally controlled curriculum based on dominant culture norms leaves almost no space for the cultural identities and particularities of varied ethnic and deprived-social-class children. It fails to address the issues of human groups and human cultures and the need human beings have for guarding their own identity and traditions "Curriculum knowledge ought not be treated as a scared text but developed as part of an ongoing engagement with a variety of narratives and traditions that can be re-read and reformulated in politically different terms" (Giroux, 1996).

Our schools and other educational institutions have failed to create enabling cultures for learners. Successful school cultures that provide learning communities for all, serve as counter cultures which help to raise the consciousness and metacognition of its members, enhancing their self-esteem and interest Counter cultures would also help to carry the message from school to society at large Culture of education ought to be participatory, proactive, communal, collaborative and given over to constructing meanings rather than receiving them Today, when the concepts of global world order and corporate forces are set to give direction to our education, constructivism should be the underlying approach in education, and critical pedagogy the basic methodology Education should essentially aim at producing critical thinkers who have a keen sense of judgement and the courage to question and challenge what is deemed undesirable.

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Some Issues in Public Examinations with Reference to Chemistry Paper Setting at the Senior Secondary Stage

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Abstract

In the present paper issues in public examinations have been analyzed with reference to chemistry paper setting at the senior secondary stage supported by evidences obtained by analysis of chemistry question papers of Class XII of a few boards of education. Issues relevant to chemistry question papers are more or less the same for other subjects also. Testing of learning objectives of a subject, content coverage, difficulty level and equivalence of different sets of question papers and valuation of the answer books have been identified as some of the burning issues. There are bound to be variations in the weightage given to different objectives but variations in different sets of question papers of the same board in terms of objectives, difficulty level and content coverage lead to wide gaps in the achievement levels of learners for no fault of theirs. The task of paper setting should be entrusted to experienced teachers who have received training in techniques of paper setting.

EVALUATION is one of the most important components of any programme This becomes more pertinent when the programme is related to the development of human beings. Knowledge explosion in the field of science is taking place at a very fast rate, especially due to the increasing role of the visual media. For the continuous development of students, continuous and comprehensive evaluation is suggested. According to Ahman and Glock (1954), overall purpose of evaluation should be to provide information to enable each pupil to develop according to his/her potential within the framework of the educational objectives of the school Most of the schools are trying to follow this practice by conducting unit tests, terminal tests and the annual examination. Evaluation is supposed to be done to test whether the pre-decided goals and subject specific objectives have been achieved by the learners Evaluation is also done in identifying the weak spots in the subject specific areas and also the mistakes committed by the learners It does help in retrospecting about the learning strategies being adopted by the learners and working out the modifications needed to improve the learning level of the students.

The State Boards of Education have taken up the responsibility of holding public examination at the end of Class X and Class XII These examinations are held at some places with strict vigilance and at some places vigilance is lax. Results are declared, some students are promoted and some are detained Schutz (1971) views examination or testing as "an active synergistic partner contributing to the resources of other elements of education in a sense of feedback loops." Except for a few students, parents and teachers, board examination papers are accepted by most of us as such without making the effort of going through the question papers carefully to pin-point mistakes for critical appraisal of the public examinations.

A new trend of examination has been started in the country by introducing multi-sets of question papers marked 'A', 'B', 'C' and 'D' without taking any cognizance of variation in the difficulty levels of different sets Thus we create gaps in the learning levels of children who are so tested. Analysis of science question papers of Class X by Sindhu (1997) and chemistry question papers of Class XII of Madhya Pradesh, Maharashtra and Gujarat State Boards of Education by Gupta (2000) has revealed that there are different types of mistakes in the question papers. A few are listed below .

- The language of the questions is defective. The intention of the examiner is not clear due to which the examinee is confused regarding what to write and what not to write
- Most of the question papers are bilingual. It is also observed that in many cases the translated part differs in content from the English/Hindi version of the question
- There is a provision for optional questions in some question papers but there is marked difference in the difficulty level of the optional question and the time required to attempt it It is also observed that if one question is of knowledge type, the optional one is of application type

- Many question papers are found to test only the knowledge aspect of the students. Test items related to understanding and application of knowledge are lacking in most of the question papers
- Different sets of question papers differ markedly in their difficulty level.
- Some question papers are found to contain defective test items.
- Proper time and marks distribution management is rarely taken care of by the examiners
- Many question papers are found to have poor content coverage In one question paper, it was found that without studying inorganic chemistry, one could secure 95 per cent marks as the optional questions were either from organic or physical portion of chemistry.

Testing of Objectives

There is a strong relationship between objectives, teaching-learning strategies and evaluation Evaluation is a continuous process. It takes place along with knowledge transaction during the classroom process A good teacher is always concerned about the learning outcomes—inside the classroom or outside. Unit tests, terminal tests and public examinations tend to test what students have learnt in different subjects. Public examinations are the platforms where these objectives are tested on a large scale To find out to what extent these objectives are tested, chemistry question papers of Class XII of different boards of education and the Central Board of Secondary Education were analyzed. A close look at the question papers reveals that most of the objectives tested in the examinations are of the write-define-explain type. These objectives test only the knowledge aspect of the learner. Though objectives like prove, infer, relate, differentiate, extrapolate, distinguish, convert, etc also find place in the question papers, their number is very less. Detailed analysis of question papers of different boards of education in terms of objectives is given in Table 1

The Madhya Pradesh Board sets only one question paper but in the form of three sets—A, B and C The Gujarat Board sets only one paper. The Maharashtra Board sets two papers—Paper I consisting of physical chemistry and part of inorganic chemistry and Paper II consisting of organic chemistry and part of inorganic chemistry. The Central Board of Secondary Education (CBSE) also sets only one paper but in the form of three sets An analysis of the three sets of question papers of the M.P Board of 1998 reveals that not even a single question of application type was asked in 1998. Questions were either of knowledge type or of understanding type The purpose of making sets like A, B and C is to avoid copying Most of the questions may be common Their placement in different sets should be changed. The level of difficulty in the different sets and the type of questions should not vary much. If Set A consists of knowledge based questions with 53 5 per cent weightage, in Set B this weightage is reduced to 38 7 per cent. In Set A 40.7 per cent weightage was given to understanding type questions which increased to 54.7 per cent in Set B and to

TABLE 1

Comparison of Chemistry Question Papers of Different Boards in Terms of Objectives

				Knowledge			*Understanding*			*Application*			*Skill*		
Q N	*Board*	*Year*	*Set*	*No of Ques*	*Marks*	*%*	*No of Ques.*	*Marks*	*%*	*No. of Ques*	*Marks*	*%*	*No of Ques*	*Marks*	*%*
1	Madhya Pradesh	1998	A	12	40	53.3	10	30.5	40.7	-	-	-	2	4.5	6.0
			B	9	29	38.7	12	41	54.7	-	-	-	1	5	6.6
			C	9	27	36.0	13	45	60.0	-	-	-	1	3	4.0
2	Madhya Pradesh		A	10	28	37.3	8	28	37.3	4	19	25.4	-	-	-
		1999	B	11	36	48.0	8	26	34.7	2	9	12.0	1	4	5.3
			C	9	29	38.7	11	36	48.0	2	10	13.3	-	-	-
3	Maharashtra*	1998	Paper I	9	20	33.3	13	26	43.3	5	14	23	-	-	-
			Paper II	16	38	63.3	8	20	33.3	-	-	-	1	2	3.3
4	Gujarat*	1998	-	34	60	39.5	32	55	36.2	13	37	24.3	-	-	-
5	CBSE	1998	-	18	33	47.1	13	20	28.6	7	16	22.9	1	1	1.4

* Marks of optional questions are also included

60 per cent in Set C. Thus it can be inferred that the level of the three sets differed a lot. The situation improved slightly in 1999, when each set consisted of a few application type questions also The weightage given to knowledge, understanding and application type questions varied greatly in these three sets too

The Maharashtra Board makes provision for two papers in each subject Each paper is of 40 marks In paper I, 33.3 per cent weightage is given to knowledge type questions, 43.3 per cent to understanding type and 23 per cent to application type questions. As compared to this, in paper II, 63.3 per cent weightage in given to knowledge type items and 33.3 per cent to understanding type questions It is surprising to note that in Paper II, not even a single item tests application of knowledge Paper II consists of organic and inorganic chemistry wherein it is misconceived that application type items cannot be constructed in these portions of chemistry which, however, is not true Conversion of one compound into another or synthesis of one compound from the other constitutes application type items. For example, conversion of ethane into ethyne, ethanoic acid, benzene etc fall under this category. Similarly, predicting the paramagentic or diamagnetic nature of colour of ions like Fe^{2+}, Fe^{3+}, Co^{2+}, Ni^{2+}, etc. involves knowledge of the atomic number of the respective atoms, and then, writing of electronic configuration gives an idea of the number of unpaired electrons present in the ions. Such items can be answered only by application of knowledge of the related concepts. This needs to be taken care of by the examiners if they really want to raise the standard of public examinations.

Papers of the Gujarat Board and the CBSE seem to be balanced to some extent. In the Gujarat Board where only one paper is set, the question paper of 1998 was found to give 39.5 per cent weightage to knowledge type items, 36.2 per cent to understanding type and 24 3 per cent to application type items In comparison to question papers of other boards, the CBSE question paper was found to give 47 1 per cent weightage to knowledge type items, 28 6 per cent to understanding, 22 9 per cent to application type and 1.4 per cent to skill-related items.

The above analysis of question papers of a few boards reveals that there is a need for paying special attention to the testing aspect of different objectives A particular balance is to be maintained in the question paper so that students do not remain confined only to knowledge of the subject They should be able to explore further and apply their knowledge to solve problems under new situations This will help in inculcating reasoning and the scientific temper

Difficulty Level of Question Papers

Public examinations test a heterogeneous group of students, some of whom are gifted and some are slow learners. After going through the classroom instruction and self study for two years after passing Class X examination, the students face another public examination It is generally believed that 25 per cent of the questions in a paper should be easy which can be attempted by all the students Fifty to fifty-five per cent questions should be of medium level which can be attempted by average students. Question papers may also contain at least 20 per cent questions which should be really brainstorming and involve application of subject knowledge. Such items are attempted generally by very intelligent students. To study this aspect of question papers in public examinations, chemistry question papers of four boards of secondary education were analyzed. Analysis of these papers in terms of difficulty level is reported in Table 2. This analysis in based upon the opinion of chemistry teachers and teacher educators A brief description of the difficulty level of the papers is given below.

Weightage given to easy items ranged from 33 3 to 44 per cent in the three sets in 1998 in the M P. Board Examination which was reduced in 1999 to zero in set A, to four per cent in set B and to eight per cent in set C In 1998, weightage to medium items ranged from 50 7 to 57 3 per cent which, however, increased to 97.3 per cent in set A in 1999. Set B in 1999 consisted of 85.3 per cent average items in comparison to 80 per cent contained in set C. As regards weightage to difficult items is concerned, their weightage ranged from 3 7 to 13 4 per cent in 1998, to 2 7 to 12 0 per cent in

TABLE 2

Comparison of Chemistry Question Papers of Different Boards in Terms of Difficulty Level

				Difficulty Level								
				Easy			*Average*			*Difficult*		
Q. N	*Board*	*Year*	*Set*	*No. of Ques*	*Marks*	*%*	*No of Ques.*	*Marks*	*%*	*No of Ques*	*Marks*	*%*
			A	9	33	44 0	11	38	50 7	2	4	5 3
1.	Madhya Pradesh	1998	B	10	30	40 0	11	43	57 3	1	2	3 7
			C	7	25	33 3	12	40	53.3	4	10	13 4
			A	-	-	-	21	73	97 3	1	2	2 7
2.	Madhya Pradesh	1999	B	1	3	4 0	18	64	85 3	3	8	10 7
			C	2	6	8 0	16	60	80 0	4	9	12 0
3.	Maharashtra*	1998	P-I	5	12	20 0	17	40	66 7	2	8	13.3
		P-II	9	22	36.7	15	38	63 3	-	-	-	
4	Gujarat*	1998	-	20	32	21.0	56	111	73 0	3	9	6 0
5	CBSE	1998	-	11	18	25 7	18	43	61 4	5	9	12 9

* Marks of optional questions are also included

1999 In the Maharashtra Board Examination also consistency could not be observed in Paper I and Paper II. Paper I consisted of 20 per cent easy items, 66 7 per cent medium items and 13.3 per cent difficult items whereas in Paper II, the percentage of easy and average items was found as 36 7 and 63 3 respectively. No item could be termed as a difficult item in Paper II of the Maharashtra Board. Almost the same trend was observed in Gujarat and CBSE Boards. In Gujarat Board, 21 per cent weightage was given to easy items, 73 per cent to medium items and only six per cent to difficult items. The CBSE Board gave 25.7 per cent weightage to easy items, 61 4 per cent to medium and 12 9 per cent to difficult items. In a nutshell, it can be inferred that there is a need for improvement of the standard of the question papers The paper setters need awareness and training this aspect.

Content Coverage

Chemistry consists of three branches, namely, organic, inorganic and physical chemistry at the school level Different boards have given different weightage to each branch. One of the salient features of a good question paper is that it should give wide coverage to all the units covered in the syllabus If it is not possible to set questions from each unit in consonance with the weightage fixed for it, at least weightage given to a particular section/branch should be reflected in the paper so that students study the subject in a holistic manner. The pick-and-choose tendency of the students needs to be discouraged to give them a thorough idea of the subject It was in this context that it was

TABLE 3

Analysis in Terms of Weightage to Different Branches of Chemistry

Q. N	*Board*	*Year*	*Set*	*Organic*		*Inorganic*		*Physical*		*Total Marks*
				Marks	*%*	*Marks*	*%*	*Marks*	*%*	
1	Madhya Pradesh	1998	A	27	36 0	17	22 7	31	41 3	75
			B	21	28 0	19	25 3	35	46 7	75
			C	21	28 0	19	25 3	35	46 7	75
2	Madhya Pradesh	1999	A	20	26 7	23	30 7	32	42 6	75
			B	20	26 7	24	32 0	31	41 3	75
			C	20	26 7	23	30.7	32	42 6	75
3	Gujarat	1998	-	38	38.0	26	26 0	36	36.0	100
4	Maharashtra	1998	Paper-I	-	-	10	-	30	-	40
			Paper-II	32	-	8	-	-	-	40
				32	40 0	18	22 5	30	37 5	80
5	CBSE	1998	56/1	24	34 3	15	21 4	31	44.3	70
			56/3	26	37 1	12	17 2	32	45 7	70
6	CBSE	1999	56/2	27	38 6	11	15 7	32	45 7	70
			56/3	26	37 1	15	21 4	29	41 5	70

thought necessary to analyze the chemistry question papers of different boards Branchwise weightage calculated from different question papers of four boards is given in Table 3 Following is a brief discussion on this aspect

As regards physical chemistry, both M P and CBSE Boards have given more than 40 per cent weightage to it. In the M.P. Board, this weightage is found to vary between 41 3 per cent to 46.7 per cent in 1998 question papers, whereas in 1999 question papers, weightage of around 42 per cent could be observed in all the three sets CBSE gave 44.3 per cent weightage to physical chemistry in 1998 and 45.7 per cent in 1999 except in one set in which it was observed as 41 5 per cent. Gujarat and Maharashtra Boards give almost 36 per cent weightage to it However, weightage given to inorganic chemistry and organic chemistry differ a lot. In the M.P Board, it varied between 22.7 per cent to 25 3 per cent in the 1998 examination whereas in 1999 it remained almost constant at about 31 per cent In the Maharashtra Board, it was found to be 22 5 per cent in comparison to 26 per cent in the Gujarat Board In CBSE, weightage given to inorganic chemistry was found to be 21.4 per cent in Set 56/1 in 1998 and Set 56/3 in 1999 but weightage was found reduced to 15 7 per cent in Set 56/2 in 1999 and 17.2 per cent in Set 56/3 in 1998 There is need for serious deliberations on this issue by the Board authorities and paper setters.

Inter-board comparison of weightage given to organic chemistry reveals that there is a wide difference of weightage given to this branch. Except the M.P. Board, all other Boards give weightage of around 38 per cent or more to this branch but in question papers of Madhya Pradesh, it is around 27 per cent However, in set A of the M.P Board of 1998, it was found to be 36 per cent. In set A, weightage given to organic, inorganic and physical chemistry varied as 36 per cent, 22 7 per cent and 41 3 per cent respectively but in sets B and C it was found to be 28 per cent, 25.3 per cent and 46.7 per cent respectively It is amply clear from these data that set A differs from set B and set C in terms of weightage given to different branches of chemistry due to which there is bound to be a difference in the achievement level of children for no fault of theirs. However, this deficiency was not observed in the M P. Board sets of 1999 where weightage given to different branches in different sets remained the same i e 27 per cent to organic, 31 per cent to inorganic and 42 per cent to physical chemistry.

Valuation of Answer Books

In unit tests and terminal tests, answer books are shown to the students. In case of any error or doubt, students can get it rechecked and corrected by their teachers However, when students are not satisfied with the marks obtained by them in public examination, after declaration of results, another cumbersome exercise of revaluation starts. The number of dissatisfied clientele being very large, the Board is under tremendous pressure and most of the students get a printed card bearing the message "No change in your marks " This is a genuine problem of the students. Let us try to find out the genesis of this problem In the seventies and the early eighties, answer-books used to be sent to the examiners at their residence The examiners would check the answer-books at their homes in a leisurely mood, read the scripts thoroughly and assign marks accordingly Most of the examiners would complete the task in time and there were only a handful of complaints. But that system also was not foolproof. Some of the examiners did not complete the valuation work in time or did not do it at all and sent the marks without evalauting the answer-books Cases were also reported of examiners contacting the concerned school authorities for obliging them There have been cases of unchecked answer-books lying in the railway station while results are declared giving average marks to students of that particular centre Keeping these evils in view, most of the Boards have now opted for central valuation to complete the task in time. On an average, one teacher is to evaluate 30-40 answer-books in one day. There are examples when some of the examiners evaluate more than 50-60 answerbooks in a day within 5-6 hours. If an examiner devotes five hours at a stretch in a day for evaluating 30 answer-books, he/she gets only 10 minutes for one answer-book. Question papers of M.P. and Maharashtra Boards consist of 22 questions with 25 sub-parts; the Gujarat Board paper consists of three sections with 53 questions and the CBSE Board paper consists of 34 questions with 50 sub-parts. Just imagine the fate of the examinee when, due to time constraint, the examiner cannot devote more than 7-8 minutes on one answer-book and not more than 10-15 seconds on one answer. Within 10-15 seconds, the examiner is to go through the answer, analyze it and mark it. For raising the credibility of the Boards, it is, therefore, suggested that one examiner should be given only 20 answer-books to be evaluated in 5-6 hours. Only in exceptional cases, 30 answer-books may be allotted to the examiner. The examiners may be compensated by enhancing the rate of evaluation work.

The issues raised in the present paper apply not only to chemistry question papers but, more or less, to question papers in any subject. Paper-setting assignment should be given only to those experienced teachers who have received training in techniques of paper setting. After deciding the weightage to be given to different objectives, types of questions and their difficulty level, a blueprint of the question paper should be prepared by board authorities and a copy of the blueprint should be supplied to the examiner Eight to ten sets of question papers may be got prepared by the board and three or four equivalent if not identical sets be developed by the moderators in the board Seventy-five to eighty per cent questions in different sets may be common with different placements to check copying by the examinees. The remaining 20-25 per cent questions may be different but their difficulty level and objectives should be the same. For example, if a numerical question is asked in one set, the other sets should also have numerical problems of a similar type with different data. Vague questions should be avoided Questions should have only one answer Translation, wherever required, should be correct. By controlling these parameters, different sets of almost the same level may be developed. This may be helpful in making a correct assessment of the examinees and the credibility of public examinations conducted by different boards may also be enhanced

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Influence of Parental Literacy on the Academic Achievements of Children belonging to the Backward Classes

A Study of Kamrup District

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Abstract

For the real development of any country every section of the society must be educated so that every individual can contribute effectively in the process of the development of the country. This study focuses on Kamrup District, Assam and throws light on the education of the Backward Classes. The study tries to find out the causes of their low academic achievements and suggests remedial measures.

EDUCATION undoubtedly serves as the main agent and component of overall social, political and economic developments of a nation. Education has been recognized as one of the most significant instruments for changing the socio-economic status of the people of a country and illiteracy is the greatest impediment to any improvement in the socio-economic status of the people. Education upto a certain minimum level is a basic necessity for all. On the threshold of the twenty-first century we are in a world of science and technology where education is the only instrument that can bring about the desirable changes for growth and development.

India is a vast country with a huge population, which has diverse religions, languages, castes, communities, etc. In Assam also people of different castes reside together, some of whom belong to the Advanced Classes and some to the Backward Classes.

In India, governmental as well as non-governmental organizations are giving the most importance to the removal of illiteracy to attain a minimum level of learning. Despite this only 52.11 per cent people of India and 52.89 per cent people of Assam are literate according to the 1991 census report. Out of the 23 districts of Assam, Kamrup District's percentage of literacy is 67.5 per cent, which is second best in Assam. Even then it shelters more than nine lakh illiterates.

Table 1, given below shows the total and sexwise population by caste in Kamrup District. Here we see that the percentage of Scheduled Caste population to the total population is 7.54 per cent and Scheduled Tribe population to the total population is 10.72 per cent.

TABLE 1

Total and Sexwise Population by Caste in Kamrup District

District	*Total Population*			*Scheduled Caste*			*Scheduled Tribe*		
	Male	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*
Kamrup	10,64,649	9, 35,422	20,00,071	79,010	71,733	1,50,743	1,09,286	1,05,054	2,14,340

Source. Census of India 1991, series-4 Assam
'Aspects of population profile of Assam'

In reviewing different literatures the investigator found that Dr R.N. Bhattacharjee in 'Studying the socio-economic strategies of education in Nagaland', Dr Vijayalakshmi of Patna in her 'Study of academic achievement of the Scheduled Castes and Backward castes', Dr R.C. Das's 'Investigation into the problem of wastage and stagnation at the primary level of education in the District of Sibsagar', identified a major problem from among different problems in attaining minimum level of learning, i.e., academic achievement of the children—the causes of wastage in primary education are parental illiteracy, their ignorance and indifferent attitude towards their children's education Besides this, the Backward Classes i.e., Scheduled Castes and Scheduled Tribes are considered backward in education as compared to the Advanced Classes. Hence, the investigator felt the need for studying the academic achievements of the children of literate and illiterate parents of the Backward Classes. Here academic achievement means successfully completing lower primary education within the stipulated time of four years.

Objectives

1. To study the academic achievements of first-generation learners (FGLs) i.e. the children of illiterate parents and non-first generation learners (NFGLs) i e. the children of literate parents of the Backward Classes.
2. To study the academic achievements of the FGL boys and girls of the Backward Classes.
3. To study the academic achievements of the NFGL boys and girls of the Backward Classes.
4. To find out the causes of low academic achievements and suggest remedial measures to the children of the Backward Classes.

Hypotheses

1. There is no significant difference in academic achievements between the FGLs and NFGLs of the Backward Classes.
2. There is no significant difference in academic achievements between FGLs boys and girls of the Backward Classes.
3. There is no significant difference in academic achievements between NFGL boys and girls of the Backward Classes.

Area

The study was conducted in the Sonapur area of the Kamrup District of Assam.

Sample

For this study altogether 154 samples were collected from five different schools of Sonapur area. The names of the schools and the number of samples collected from the Backward Classes are shown in Table 2

TABLE 2
Number of Samples Collected from Different Schools of Sonapur Area

	Names of the Schools	*Number of Samples Collected*
S_1	1 No. Borkhat L P School	19
S_2	Hahara Primary School	33
S_3	Talelia Govt Buniyadi Vidyalaya	64
S_4	Karchia Primary School	20
S_5	Dapata Kalikajari Primary School	18
	Total Samples	154

Tools

In this study the investigator used the stratified sampling technique and the following tools for data collection.

1. Inquiry form
2. Interview schedule
3. Observation

To know about the academic achievement, parents' education, income, caste, etc of the students, an inquiry form was used. Interview schedule was prepared to know about the causes of failure and success in the examination. The school and home environments of the children, attitude of the parents towards the education of the children were observed by the investigator while visiting the houses of the samples collected

Method

Normative survey method was employed for the study.

Limitations of the Study

This study has been limited to five Assamese medium primary schools of Sonapur area. The children belonging to the Scheduled Castes and Scheduled Tribes were selected for the study. Besides this, no sample was collected from private and venture schools.

The study was confined to the lower primary stage i.e. Classes I to IV only and not the entire primary stage

Regarding income level, the study was limited to the income levels of the parents of the samples collected. Here the family income ranging from Rs 900 to Rs 4800 per month was tabulated under frequency distribution and those entered under Q_1 i e., below Rs 1500 per month, regarded as low income level, above Q_3 *i e* Rs 3550 per month as high income level, and between Rs 1500 and Rs 3500 per month as middle income level.

The study was limited to the Scheduled Caste and Scheduled Tribe children.

Analysis of the Data and Statistical Techniques Used

The academic achievements of 71 boys out of whom 51 were FGLs and 20 NFGLs, and 83 girls out of whom 63 were FGLs and 20 NFGLs were followed for four years from 1992 to 1995 i e. from entering Class I in 1992 to successfully completing the lower primary stage i.e. Class IV in 1995.

Samples were divided sexwise, income-level-wise and groupwise i.e , as first-generation learners and non-first-generation learners which are shown in Table 3.

The academic achievement of the 71 boys and 83 girls was followed from year to year and one who failed or left school was considered as a case of wastage. Thus in 1995 only 26 students had successfully completed the lower primary stage i.e. passed Class IV Out of these 26 students only one was FGL and the others were NFGLs. Table 4 shows the groupwise, sexwise and income-level-wise number of students who passed Class IV in 1995 from among the students admitted in Class I in 1992.

TABLE 3

Sexwise, Income-level-wise and Groupwise Number of Samples Collected

Sex	*High Income Level (HIL)*		*Middle Income Level (MIL)*		*Low Income Level (LIL)*	
	FGLs	*NFGLs*	*FGLs*	*NFGLs*	*FGLs*	*NFGLs*
Boys	10	9	10	9	31	2
Girls	13	11	13	5	37	4
Total	23	20	23	14	68	6
	43 (HIL)		37 (MIL)		74 (LIL)	

TABLE 4

Groupwise, Sexwise and Income-level-wise Number of Students Who Passed Class IV in 1995

	Income Levels							
Sex	*HIL*		*MIL*		*LIL*		*Total*	
	FGLs	*NFGLs*	*FGLs*	*NFGLs*	*FGLs*	*NFGLs*	*FGLs*	*NFGL*
Boys	0	8	0	4	0	0	0	12
Girls	0	7	1	3	0	3	1	13
Total	0	15	1	7	0	3	1	25
	15		8		3		26	

Total, sexwise, groupwise and income-level-wise pass percentage of the students was calculated by applying the formula

$$\text{Percentage of academic achievement} = \frac{\text{No of students who passed Cl IV in 1995}}{\text{No of students enrolled in Cl. I in 1992}} \times 100$$

Here the pass percentage of the students indicates their academic achievement In computing pass percentage it was found that the overall pass percentage is only 16 9 per cent. In NFGL group it is 62 5 per cent but in FGL group it is only .88 per cent The academic achievement of the FGL boys is 0 per cent and of FGL girls it is 1.6 per cent. But the academic achievement of the NFGL boys is 60 per cent and of the NFGL girls it is 65 per cent. The academic achievements of the FGLs and NFGLs shown graphically will give us a clear picture of the academic achievement of these two groups along with the academic achievement of both the groups together.

To test the significance of the difference between the academic achievements of the FGLs and NFGLs Chi-square test was done by applying the following formula

$$X^2 = \Sigma \frac{(fo - fe)^2}{fe}$$

Here the Chi-square value is found as $x^2 = 80'18$

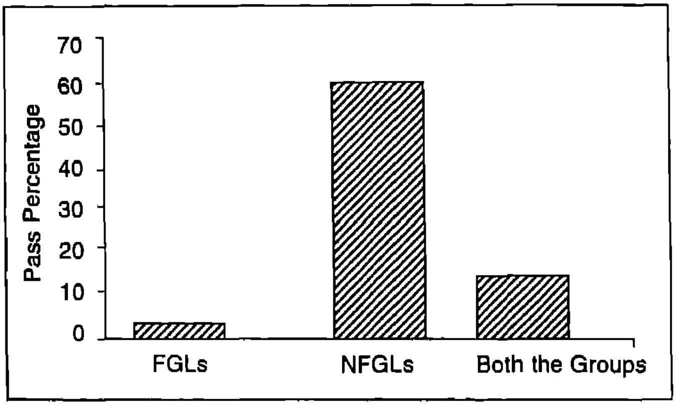

Fig. 1 : *Academic achievement of FGLs, NFGLs and both the groups*

Df = 1

The critical values at

1 per cent level of significance = 6 635

5 per cent level of significance = 3 841

So, significant difference is found in the academic achievements of FGL and NFGL groups beyond one per cent level of significance

Conclusion and Suggestions

In studying the academic achievements of the students of the Backward Groups it has been found that the children of literate parents show better academic achievement than the children of illiterate parents. The academic achievement of the FGLs is very low i.e. only .88 per cent but in case of NFGLs the academic achievement is 62.5 per cent

Besides this, the academic achievement of the girls is comparatively better than that of the boys i.e., 65 per cent and 60 per cent respectively.

The wastage rate is very high in the FGL group i.e., 99 per cent as compared to the NFGL group where it is 37.5 per cent.

Besides this, the economic condition of the family also influences the academic achievement of the children as is obvious from the following data.

HIL	-	34.88	per cent
MIL	-	21.62	per cent
LIL	-	4.05	per cent

To test the significance of this difference in academic achievement the Chi-square test was applied and the Chi-square value i.e. $x^2 = 19.093$ in two degrees of freedom is found highly significant beyond one per cent level of significance as the critical x^2 values in 2 df are – 9.210 at one per cent level of significance and 5.991 at five per cent level of significance.

Through observation and by interviewing the children and their parents the causes behind low academic achievement of the children are found as follows.

1. The parents of the FGLS are not aware of their children's education. They

remain busy in household work and pay no attention to their children's education

2 Illiterate parents cannot guide their children at home in their studies.

3. Parents engage their children in household work in study hours.

4. Lack of facilities such as table, chair, lamp, dress, etc. also affect the academic achievement of the children.

The overall academic achievement is very low i e., 16.9 per cent only, due to the very low academic achievement of the FGL group The academic backwardness in the Backward Classes is not because they belong to the Backward Classes, but mainly because adult illiteracy is more prevalent among the Backward Classes

Through observation and by interviewing the parents and children, the investigator found that the literate parents of the Backward Classes are highly aware of their children's education Besides this, they try to give their children guidance and facilities for education.

In conclusion, it can be suggested that to remove illiteracy, to attain the minimum level of learning, special care and attention are needed for first-generation learners. This is not because they belong to the Backward Classes but because they are first-generation learners and they should get equal treatment irrespective of the class and caste to which they belong.

Gender Differences in Mathematical Abilities

Are They Real ?

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Abstract

Many research studies have focused on the low proportion of girls opting for mathematics. In recent years, the importance of learning mathematical skills has increased due to its demand in the job market. This article reviews research work in gender differences in mathematical abilities, particularly in cognitive, affective and psychomotor domains.

GENDER differences in mathematical abilities continue to attract much research attention. History reveals that women's education was started very late almost in all countries In the United States, the founding of Harvard College in 1636 demonstrates that admission in this college was beyond the reach of all women In England, Oxford and Cambridge Universities refused to admit women to full membership till 1919 and 1948 respectively. Herbert Spencer, a great educationist, argued that the intellectual attributes of women developed differently in the course of evolution. Women were thus deficient in the powers of abstract reasoning and in the most abstract of the emotions, the sentiment of justice. Germany was also less favourable towards the education of women. In developing and underdeveloped countries women's education was not given due place till 1950. The proportion of girls opting for mathematics in school and college is still very low, particularly in India Before 1975, the proportion of female and male was 1 and 40

In recent years, the importance of mathematical skills in the job market has attracted girls to opt for mathematics as one of the subjects of their study Marrett and Gates (1983) found no gender differences in enrolment Enrolment patterns in different schools seemed to vary more by school than by sex Marrett and Gates' results may be true for developed countries like the United States of America and the United Kingdom. In India, the situation is quite different. English-medium schools like Delhi Public School, Mayo College, Ajmer, Scindia College, Gwalior, managed by private bodies and missionaries may have equal number of girls and boys studying mathematics But the number of girls in other schools, particularly, in the schools of rural areas or in semi-urban areas, is very low Cultural and social factors are highly responsible for the under-representation of girls in mathematics The second reason of under-representation of girls may be male dominance. Charles Darwin, a renowned mathematician, admitted that his sister was brighter than he was (F. Darwin, 1929). Adele Galton tutored her famous brother Francis Galton (Peason, 1914). But the names of Mesdames Darwin and Galton have not been give due place in the history of mathematicians. Women's achievements were defined in terms of motherhood and nurturance Male mathematics teachers, parents and so-called educated members of the Indian society still discourage girls from studying mathematics Male mathematics teachers discourage girls in the classroom. A large section of the society considers girls a liability and boys an asset. Before and after school hours, girls are asked to help in domestic work by the parents Generally, parents never disturb their sons while they are studying. Such discriminatory views of parents and male mathematics teachers demoralize girls

Several brilliant women have done commendable work in mathematics Shakuntala Devi, a mathematics genius and a prodigy, is an institution in herself In Dallas, Texas, she calculated faster than the computer the cube root of 188138517. Maria Gaetana Agnesi of Italy is also a famous mathematician. She occupied for a time the chair of mathematicians in the

University of Bolongs. Her work in analytic geometry is well known Barbara Holland was the youngest girl to take admission at the age of 12 years in the mathematics department of Melbourne University, Australia She was invited especially by the Oxford University, London These are some examples which indicate that girls are not inferior by birth They are equally talented.

The results of several surveys clearly indicate that the number of girls offering mathematics or maths-related courses was less than boys upto 1970 in the developed countries But Armstrong (1981) reported that the differences have diminished in recent years. In India, the number of girls offering mathematics at the intermediate or college level is increasing. Twenty years hence the ratio of boys and girls offering mathematics may be equal, but at present it is about 3·10. Katiyar (1979) reported no significant difference between boys and girls studying advanced mathematics on the achievement test.

Gender Differences in Cognitive Abilities

Several investigations and reviews regarding sex differences in mathematics achievement have been conducted which report that in Class VI and beyond, boys are somewhat superior to girls in arithmetic reasoning, spatial abilities and problem-solving (Aiken, 1970; Armstrong, 1980; Fennema and Carpenter, 1981, Marshal, 1984) and girls are somewhat superior to boys in verbal ability, arithmetic fundamentals and rote learning (e.g. computations) But sex differences in abilities are less pronounced in the earlier classes, and there is a general differentiation of abilities with age and experience. A critical review of research literature of the1960s prepared and delivered by Eleanor Maccoby and Jacklin in 1972 highlighted that girls tended to be superior to boys in verbal abilities, whereas boys tended to be superior to girls in spatial and maths aptitudes. Results from a national survey conducted for the Education Commission of the States of 1952 13-years-olds and 1788 high school seniors provides a different picture from some of the earlier studies conducted in the area of sex differences in mathematical abilities The average mathematics problem-solving score of the 13-years-old girls in this survey was nearly equal to that of the 13-year-old boys, but, the girls' average in computation and spatial visualization was higher than that of the boys However, the situation changed by the end of high school. Armstrong (1980) reported that Class XII boys were superior to girls in problem-solving and girls had lost their earlier advantage in spatial visualization.

Differences between the sexes are often found in specific areas of mathematics. For example, men were found superior to women in geometry (Hashaway, 1981, Stones *et al*, 1982). Women were found superior to men in fractions in Hashaway's (1981) study Men, on the other hand, tended to surpass women in ratio, proportion, and in percentage in Hashaway's (1981) study and in measurement, relations, and probability and statistics in Stones, Beckman, and Stephen's (1982) study. In a study, Swafford (1980) reported that females achieved as well as, and, in some instances, better than males in the standardized first-year algebra test Smith and Walker (1988) also supported Swafford's findings. They reported females better than males in the ninth and eleventh class papers In contrast, Ethington and Wolfe (1984) reported that women scored somewhat lower than men in a combined test of mathematics even after controlling for the effects of parental education, spatial and perceptual abilities, high school grades, attitude towards mathematics and exposure towards mathematics course They concluded that there is a complex interaction among sex, selected other variables, and mathematics achievement In a recent study, Patel (1997) also reported boys better than girls in achievement in mathematics. The contradictory results mentioned above do not provide any evidence of gender differences in mathematics.

Very few attempts have been made on the issue of mathematically precocious youth and it was reported that the number of mathematically talented boys exceeded the number of mathematically talented girls In the last 20 years of the last century the situation has changed a lot At present, in India, the difference in the number of mathematically talented boys and girls is negligible

The other studies conducted in this area reflect very promising findings Data from the Second International Mathematics Study were used by Hanna (1986) to examine sex differences in mathematics achievement of Canadian Class VIII students Five areas were surveyed· arithmetic, algebra, probability and statistics, geometry and measurement No significant differences were reported in the performance of boys and girls on the first three subsets. In geometry and measurement, the boys' mean was somewhat higher than that of the girls These differences, though not large, were statistically significant at the 0 01 level. Battista (1990) did not find any sex differences in logical reasoning or use of geometry problem-solving performance. In contrast, Moore and Smith (1987) compared the mathematics achievement of young men and women, aged between 15 and 22 years. They reported that males generally outperformed their female counterparts in arithmetic reasoning and mathematics knowledge test.

In the area of mathematical creativity, very few studies have been conducted. Tuli (1982) reported that boys scored higher in mathematical creativity test than girls. Singh (1986) reported that males were not invariably superior to females on any dimension of mathematical creativity. Vora (1984) supported Singh's findings

In many cases, boys were found better than girls in mathematics achievement test One of the reasons for this variability may be boys' greater exposure to mathematics. Males also practice mathematics skills outside school more than females Girls are usually expected to be more accomplished in language and socially-oriented skills, and boys are supposed to perform better in mathematical, mechanical, and other analytical or problem-solving skills The effect of exposure/special training in mathematical skills have been studied by several investigators Ferrini-Mundy (1987) conducted an experimental study in which the effect of spatial training on calculus achievement, spatial visualization in problem-solving on solids and revolution was investigated. Students enrolled in a calculus course individually completed six spatial training modules over an eight-week period. No significant differences were found between males and females before the experiment. After the experiment girls performed better than boys which indicates that those groups given exposure did better than their counterparts. Szetela and Super (1987) studied the effect of a yearly programme on problem-solving strategies They reported very few significant results between males and females Noss (1987) reported logo experience effects in favour of girls Curcio (1987) studied the effect of graph comprehension. No significant difference was found between boys and girls

Besides exposure, heredity was also found an important factor for gender differences in mathematics ability Witelson (1976) reported that the same brain structure may have different cognitive functions in boys and girls at the same age level. He further reported that, in case of boys, by the age of six the right cerebral hemisphere dominates the left hemisphere in processing non-linguistic spatial information. With girls, however, not until adolescence does the right hemisphere become dominant in processing spatial information Hemispheric specialization or lateralization is developed earlier, or more strongly in girls than boys. Dominance of the right hemisphere by the left is associated with poorer spatial ability, which is controlled by the right hemisphere, in girls Boys, on the other hand, develop greater right hemisphere specialization or dominance Luchins (1981) suggested that the poorer spatial ability of females who study mathematics leads them to choose algebra rather than geometry or topology.

Gender Differences in the Affective Domain

Studies on gender differences in mathematics have not been limited to cognitive variables, affective and psychomotor differences have also been observed. Aiken (1974) reported that boys scored significantly higher than girls in the test of mathematical and scientific aptitudes and the discrepancies between the sexes increased with age Urban boys were also found superior to female counterparts in mathematical aptitude (Pandey, 1980) In contrast, Fennema and Sherman (1977) concluded that females as a group do not have less aptitude for mathematics than males. Callan (1985) conducted a study in the area of computer aptitude and interest. He administered Computer Aptitude, Literacy, and Interest Profile (CALIP) on a sample of male and female students. In this study women obtained equal, and, in some cases, better scores than their male counterparts in computer aptitude, but women did not score as well as men in computer interest.

Unfortunately, there was a methodological flaw in the Fennema and Sherman (1977) investigation, which makes interpretation of the results unclear The investigators undoubtedly realize that even if sex differences in mathematics achievement are reduced when mathematical experiences, and attitude towards mathematics are equated for boys and girls, it does not prove that there are no gender differences in aptitude towards mathematics. Analysis of co-variance used in this study does not control gender differences in mathematics aptitude and leaves much variance in sex. Partial correlation should be used for removing gender variables

Benbow and Stanley (1980), summarizing data on a large sample (N = 9927) of intellectually gifted junior high school students, concluded that gender differences in mathematical attitude result from superior male mathematical ability, which may be related to greater male ability in spatial tasks. Attitude towards mathematics tends to be less positive and less variable in girls (Schofield, 1982) It was the opinion of the investigator that separate regression equations should be developed for boys and girls for predicting achievement in mathematics from attitude towards mathematics As author of this paper I do not agree with Schofield's opinion. If biological differences between males and females are so strong or gender differences in mathematics are God-gifted, then there is a need to develop separate regression equations for boys and girls, otherwise, it has no meaning at all. Hacket and Betz (1984) reported that mathematics performance and self-efficiency were positively and significantly correlated with attitude towards mathematics and masculine sex-role orientation Cynthia (1991) reported that gender had a significant effect on attitude towards mathematics.

Gender differences in interest in mathematics have been studied by Razik and Zakaria (1995), and Lalithamma (1975). Razik and Zakaria (1995) reported significant differences between boys and girls in the development of interest in different areas of mathematics. Boys were found higher than girls on interest in mathematics (Lalithamma, 1975). She also reported that boys were higher on intelligence than girls It may be one of the reasons for greater male variability on interest in mathematics Comparison of boys and girls on affective variables in mathematics without controlling extraneous variables and minimizing error variables have no meaning at all.

Gender differences in anxiety towards mathematics have been studied intensively by Hembree (1990). He used meta-analysis to synthesize the findings of 151 studies—mainly articles in journals, ERIC studies, documents, and doctoral dissertations. He reported that at each grade level (K-12 and post secondary) females reported greater mathematics anxiety than males. At both the junior and senior high school levels, high anxiety affected mathematics performance less for females than for males High anxious females were on average also more likely to continue with mathematics than high anxious males Springer (1995) reported significant positive correlation between sex role stereotyping and mathematics anxiety. He further reported no significant relationship between sex role identification and maths anxiety Verma (1991) also reported no significant difference between males and females in a test of mathematics anxiety

Gender differences in cognitive variables may be due to anxiety towards mathematics Practically, I found that anxious boys and girls do not prefer mathematics. Mathematics has been considered a chance-factor subject by many boys and girls. Chances of right and wrong always create anxiety among students Those students who are not risk-takers are always under the grip of anxiety and this anxiety affects the level of achievement in mathematics. For example, several students, after obtaining a postgraduate degree in mathematics, opt for arts and social science subjects in the Indian Administrative Services examinations They are not sure that they will do well in mathematics. Intensive studies are to be carried out to find out the exact gender differences in mathematics particularly the effect of affective and psychomotor variables.

Leisure time is very important for secondary and higher secondary students. In leisure time, some students prefer to study mathematics books while others want to play chess or other games. Researchers in this field correlated leisure-time activities with career expectations of male and female students (Boswell, 1985, Fennema and Sherman, 1977, Fox *et al.,* 1985, Joffe and Foxman, 1986, Leder, 1988; Sherman and Fennema, 1977) The vocational intentions of the two groups confirm that competence in mathematics is a more important prerequisite for attainment of career ambitions of males than females Maires (1985) has argued in this direction that "ideology of men enables them to select mathematics as a meaningful area of activity and their life structures enable them to pursue it as a career. The ideology of women deflects them away from focused attention on mathematics and their life structures militate against their pursuit "

Gender Differences in the Psychomotor Domain

Personality characteristics of famous male mathematicians like Einstein, Fubini, Paeno have been recorded in the autobiographies of these mathematicians Though at that time there were few famous women mathematicians, due to male dominance the names of famous women mathematicians were not given due weightage. The personality characteristics of famous women mathematicians were not recorded in the history of mathematicians.

Plank and Plank (1954) claim that mathematics is primarily a masculine enterprise because a high level of controlled aggression is necessary for mathematical activity. Therefore, women who like mathematics tend to identify with a strong male figure Elton and Rose (1967) also supported the above findings They reported that college girls who were average in English but good in mathematics had higher theoretical and lower aesthetic (i e more masculine interests) than girls who were good in English but average in mathematics achievements. These writers concluded that 'masculine role' is an important factor to consider in predicting differences in ability in English and mathematics Helson (1967) reported wide individual differences among the creative mathematicians. In general, the creative male mathematicians were characterized as more assertive, outgoing, and enriched in personality than the creative female mathematicians, they also possessed higher social status, more self-assurance, and participated in professional activities to a greater extent A further study conducted by Helson and Crutchfield (1970) explored variations in personality within a group of 34 creative mathematicians. These mathematicians occupied the professor's chair in different universities of the United States The results of a cluster analysis of scores on a Mathematicians' Q-Sort were interpreted as evidence for five personality types within this group . an "adapted" type, a "conflicted" type, two "patriarchal creative" types, and one "matriarchal creative" type Stamp (1979) also reported differences between the girls who opted for mathematics and those who did not He reported that the girls who opted for 'A' level mathematics were found to be more reserved, tough-minded, radical and group-dependent and less feminine In contrast, Lambert (1968) found no significant correlation between mathematics proficiency and masculinity of interest in either sex

Unfortunately there is a methodological flaw in the Plank and Plank (1984) and Elton and Rose (1967) investigations which makes interpretation of the result unclear The investigators undoubtedly realized that the effects of environmental and cultural factors were not partialled out while comparing interest patterns of girls who were high and low in mathematics 't' test and analysis of covariance used in the studies may not be fruitful statistics to predict gender differences in mathematics Partial correlation technique may be a better statistical procedure to predict gender differences in mathematics achievement through psychomotor variables.

Personality characteristics of male and female mathematically talented students have been studied by Fox (1976) Fox felt that the greater social interest of teenage girls compared with boys in the same age group, may have interfered with their concentration in mathematics There are certain age-groups in which confidence develops among boys and girls. The relationship between confidence and achievement in mathematics has been examined in a number of studies (Reyes, 1984; Fennema and Sherman, 1977, 1988, Sherman, 1980, Joffe and Foxman, 1986) Fennema and Foxman (1986) reported that males' and females' differing attitudes towards mathematics were paralleled by the difference in the test performance of the two groups. Confidence was found a good predictor of achievement in mathematics

Low confidence among girls is due to environmental factors From the very beginning parents develop confidence in their male children. Now times are changing and several parents are trying to develop confidence in their daughters also

Willing to take risk in mathematics, non-conformity in mathematics, attitude towards mathematics—these attitudinal and personality characteristics were found associated with mathematics. Generally, it was observed that girls do not want to take risk in mathematics and use the 'I do not know' option on the test of willing to take risk in mathematics. Girls were found more anxious towards mathematics than boys.

Gender differences in personality characteristics have not been confirmed. There is no feminine/masculine subject of study. Mathematics students (male or female) may differ from non-mathematics students with respect to personality characteristics But male and female students of mathematics should not differ from each other with respect to personality characteristics if age, achievement and other environmental conditions are controlled

Gender Differences in Mathematical Skills

Mathematical skills of male and female students have been studied by several researchers (e.g Marshall, 1983, 1984; Senk and Usiskin, 1983; Callahen and Clements, 1984; Rubinstein, 1985; Fennema and Tartre, 1985) Marhsall (1983) studied the kinds of mistakes made by boys and girls in mathematics tests The errors made by girls were more likely due to misuse of spatial information, use of irrelevant rules, choice of incorrect operation, negative transfer, and key-word association. Boys, on the other hand, made more errors of perseveration and formula interference, while both sexes made language-related errors but of different kinds. Marshall (1984) further conducted a study on arithmetic computations and concluded that girls were more likely to perform computations successfully than boys In contrast, boys solve story problems more correctly than girls Senk and Usiskin (1983) found no difference in the abilities of males and females in learning to write geometry proofs

Gender differences in mathematical and spatial skills in third, fourth, fifth and ninth class Black Hispanic, and White ethnic groups revealed a significant interaction between sex and ethnicity White adolescent boys scored higher than white adolescent girls but not significantly. In contrast, Hispanic adolescent girls were significantly superior to Hispanic adolescent boys in both skills. A similar sex difference in favour of girls was found in Black adolescents, but it was not significant. In contrast, Rubinstein (1985) examined computational estimation and related mathematical skills among Class VIII students Boys scored higher than girls in the total estimation test and in the order of magnitude scale, but not in the open-ended reference number scale. In this study, the investigator used different computational tasks which had different levels of difficulties. Fennema and Tartre (1985), in a longitudinal study, explored the relationships between mathematical problem-solving performance, spatial visualization, verbal skills, and sex-related differences in mathematics performance. They reported that girls tended to use pictures more during problem-solving than boys did, but it did not enable them to get as many correct solutions. Low spatial visualization skills may be more debilitating to girls' mathematical problem-solving than boys.

The wealth of work reviewed testifies to the considerable and continuing attention directed to gender differences in mathematical abilities Gender differences in mathematical abilities have not been established In most of the studies, the researchers compared male and female students without equalling the groups or without partialling out the effect of other variables which are, perhaps, more responsible for gender differences in mathematical abilities The home conditions in which Indian girls are studying must be considered in the research studies The simple 't' test was used by the researchers Analysis of variance with two or three covariates should be used by the researcher to establish gender differences, if any But it has not been done

In the developed countries the ratio of male and female students offering mathematics is almost equal. In developing countries, like India, the situation is changing Parents are now understanding the importance of mathematics in the lives of their daughters Now girls are opting for engineering, military and other related services. Several girls have joined the Indian Air Force as pilots About forty years ago, the ratio of female to male students offering mathematics was 1·100 or more About twenty years ago this ratio was 1.40 and, at present, this ratio is about 1·10. I am sure after twenty years the ratio will be 1 1.

Women constitute about half of the total population and no country can progress without the involvement of women in all fields of life

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